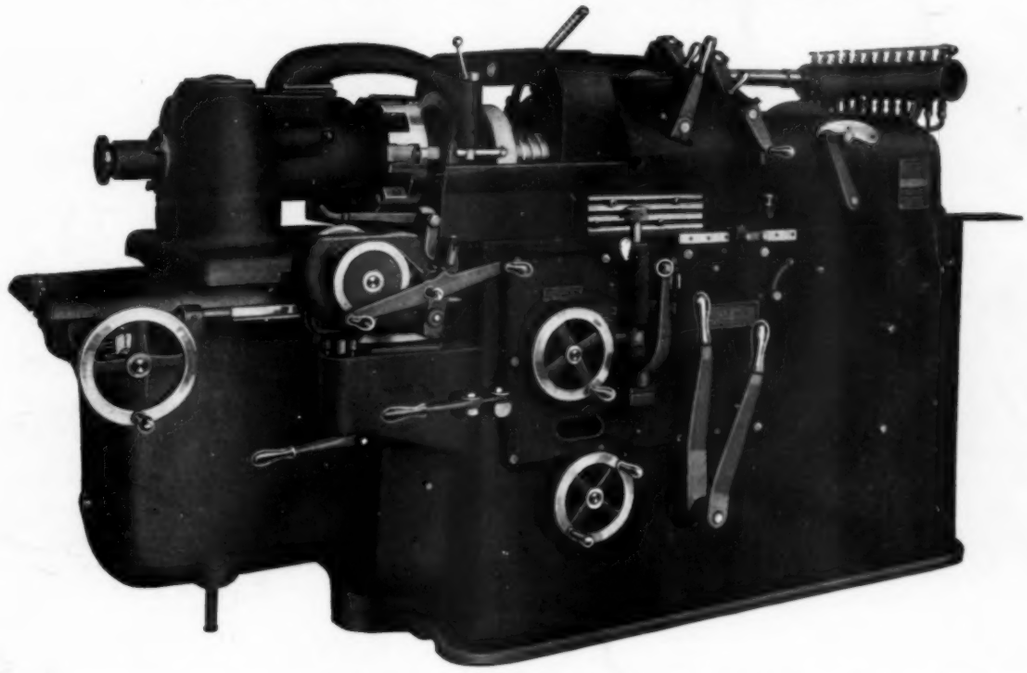
$4.00 per Year. DECEMBER 1, 1910. DEC 2 1910 Price 10 Cents.

American Machinist

A Practical Journal of Machine Construction
Issued Weekly by the Hill Publishing Co., 505 Pearl St., New York

Vol. 33. Editorial Index Page 1031. Advertising Index Page 69. No. 48.

Important Reduction In Cost Of Total Product



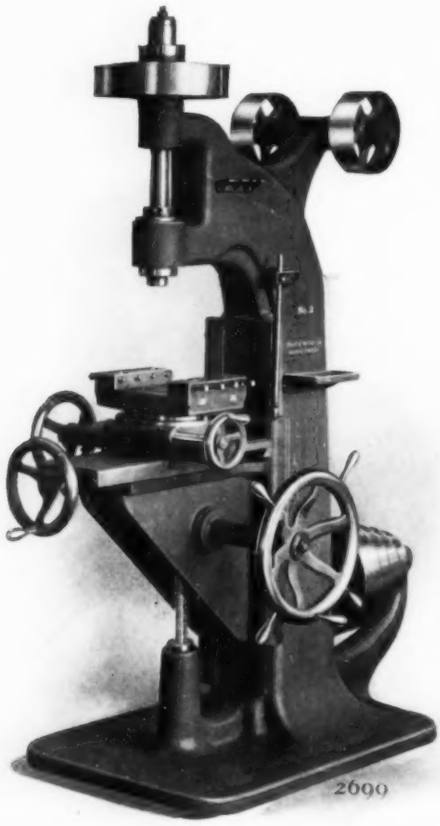
A new range of lathe work is now within the scope of the grinding process.

¶ It is now possible for you to grind all your chuck work, hard or soft, cast iron or steel.

¶ On a large variety of this class of work the Bryant Multiple Wheel Grinder is showing a 50 to 80% reduction in cost of finished product and from the nature of methods used a gain in quality.

¶ Ask us to send an expert grinding representative to look over your work and give definite information as to what our machine can do in your shop.

The Bryant Chucking Grinder Co.
Springfield, Vermont, U. S. A.



No. 2 P. & W. Die Sinking Machine.

Smooth Work Well Finished

on the **P. & W. Die Sinking Machine.** This Machine is of sturdy, unfaltering construction which is so necessary for rapidly producing dies or irregular shaped work free from chatter marks. A rigid machine also dispenses with laborious hand finishing and reduces the final and most costly labour. Two Sizes.

Write for catalog "Die Sinkers."

Vertical or Angular Milling

is made possible on the **P. & W. Hand Milling Machine** by attaching the P. & W. Vertical Milling Fixture. This is but one of the many leading features of this popular type of machine. It can be equipped with numerous attachments to facilitate special operations in any line of manufacture. Built in several sizes.

Write for catalog "Milling Machines."

Vertical Milling Fixture on No. 10 P. & W. Hand Milling Machine.

Pratt & Whitney Company

Hartford, Conn., U. S. A.

SALES OFFICES—New York, 111 Broadway. Boston: Oliver Bldg. **Philadelphia:** 21st and Callowhill Sts. **Pittsburg, Pa.:** Frick Bldg. **Cleveland:** Rockefeller Bldg. **Hamilton, O.:** The Niles Tool Works Co. **Detroit:** Majestic Bldg. **Chicago:** Commercial National Bank Bldg. **St. Louis:** 516 North Third St. **Birmingham, Ala.:** Brown-Marx Bldg. **Agents for California, Nevada and Arizona:** Harron, Rickard & McCone, 139 Townsend St., San Francisco, Cal., and 164-8 North Angeles St., Los Angeles, Cal.

Agents for Canada: The Canadian Fairbanks Co., Ltd., Montreal, St. John, Toronto, Winnipeg, Calgary and Vancouver. **London, E. C.:** Buck & Hickman, Ltd., 2 and 4 Whitechapel Road. **London, S. W.:** Niles-Bement-Pond Co., 23 25 Victoria St. **Paris:** Fenwick Freres & Co., 8 Rue de Rocroy, Agents for France, Belgium and Switzerland. **Japan:** F. W. Horne, 70-C Yokohama. **Italy:** Ing. Ercole Vaghi, Milan. **Germany:** F. G. Kretschmer & Co., Frankfurt a.M. **Holland:** Van Rietschoten & Houwens, West Zeedijk, 554, Rotterdam.

(*See page* 66)

Electrically Welded Vehicle Wheels

Editorial Correspondence

The methods followed in manufacturing light, strong steel wheels for small vehicles, which are made with special tools and put together in electric welding machines.

What is home without a baby carriage, a go-cart, or both? And what is either vehicle unless mounted upon four rubber-tired, light but strong, steel wheels with correctly proportioned rims, hubs and spokes? A few thousand wheels of this nature are turned out every working day in the year by the Welded Steel Wheel Company, of Borden avenue, Long Island City, N. Y., and it is the purpose of this article to illustrate some of the methods and tools employed in the work.

In Fig. 1 will be seen various parts of a 10-inch wheel in course of construction, and at the lower right-hand corner is an assembled and welded wheel ready for the tire. The latter, however, is not put in place at the shop, and this article will, therefore, deal only with the preparation of the steel wheel itself.

Hub Details

Considering first the hub, this, like the rim, is made of sheet stock, and the body is formed up ready for the flanges as shown at *A*, Fig. 1. This hub has four longitudinal ribs which are struck up in the blank crosswise of the stock. The dies in which these ribs are pressed up also perform the rolling-up or forming operation, which brings the piece of flat metal to a tubular form with the four exterior longitudinal ribs running about four-fifths of the entire length of the hub.

The hub flanges are made up of parts *B* and *C*, Fig. 1, the former being in the shape of washers struck up and pierced to press onto the ends of the hub, while parts *C* are provided with six projecting gears, which during the process of assembling are pressed down over the washer edges and between the wheel spokes which are welded between these two parts of the flange. The way in which the flanges are put together will be understood upon examination of the group of parts at the lower left-hand corner of the halftone, Fig. 1.

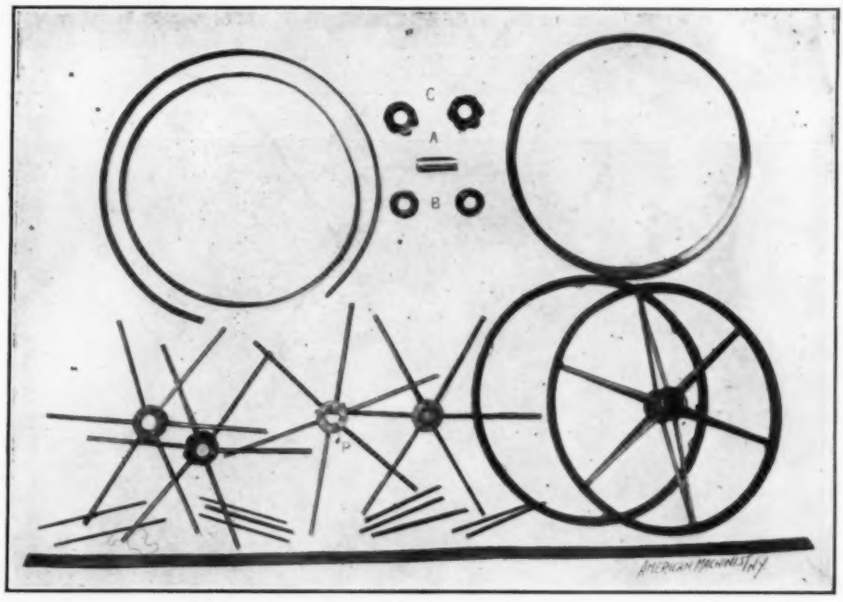


Fig. 1. Parts of a 10-inch Wheel

How the Rim Is Made

The rim is started in the form of a piece of strip stock about 0.040 inch thick cut off to length as indicated in Fig. 1, rolled up in the form of a hoop and butt-jointed by electric welding. The next step is to form a groove in the wheel, and this is accomplished with the dies shown in Fig. 2. Here the two parts of the die are practically duplicates of each other, each member accomplishing half of the forming operation.

Considering die *D*, this is made up of 16 steel segments screwed and doweled to the base block after forming to shape, hardening and tempering. As shown in the sectional sketch in Fig. 2, blocks *D* are provided with a groove formed up to approximately one-fourth of a circle whose radius is the radius of the wheel section. Half of the sections on *D* enter corresponding openings between the projecting sections on *E*, the latter interlocking in a similar manner between the projections on die *D*. When the plain, flat band in the form of a ring is slipped over the die *D* and the press ram descends, the rim section is formed into a semi-circle by the arc cut in *D* and *E*, as indicated in the sectional sketch at the left of Fig. 2. The rim in this form is shown in the upper right-hand corner of Fig. 1. The next operation required is to form the six lugs inside the rim to which the outer ends of the spokes are to be welded. One of the rims with these depressions formed inside will be seen immediately behind the completed wheel at the bottom of Fig. 1.

Another Set of Tools for Punching the Rims

Figs. 3 and 4 illustrate the press tools for this operation. In the latter view a groove *F* is shown in the die block, into which the rim is placed; as the upper member of the press descends, six radially disposed punches *G* are forced toward the center by six wedge-shape pins *G'* carried by the rams, as shown in Figs. 3 and 4, the inclined faces on the inner sides of these plungers contacting with similarly sloped faces *H* on the rear ends of the radial punches. At the same time a hexagonal punch at the center, as shown at *I*, Fig. 4, strikes the inner ends of radial dies *J*, of which there are six to correspond to the punches, and forces the dies forward against the inner surface of the wheel rim, while the lugs or projections are being punched in the rim. As the ram ascends the six wedge-shaped plungers *G'* and the hexagonal plugs *I* at the center of the punch block release the six radial punches and dies, and pressure springs *J*, which abut at one end upon the die and at the other against the punch, force the two apart and allow the finished rim to be withdrawn from the press.

The construction of these dies needs little explanation, as the sketches and halftone show the general arrangement quite clearly. It may be pointed out, however, that the radial members, that is, the six sets of punches and dies, are themselves fitted in rectangular blocks or guides, which are placed in radial slots planed in the face of the circular die block. This makes a convenient construction and also admits of ready renewal of any part which may fail or wear out in service.

Assembling Hub Flanges and Spokes

The arms or spokes for these wheels are cut off to length from stock formed

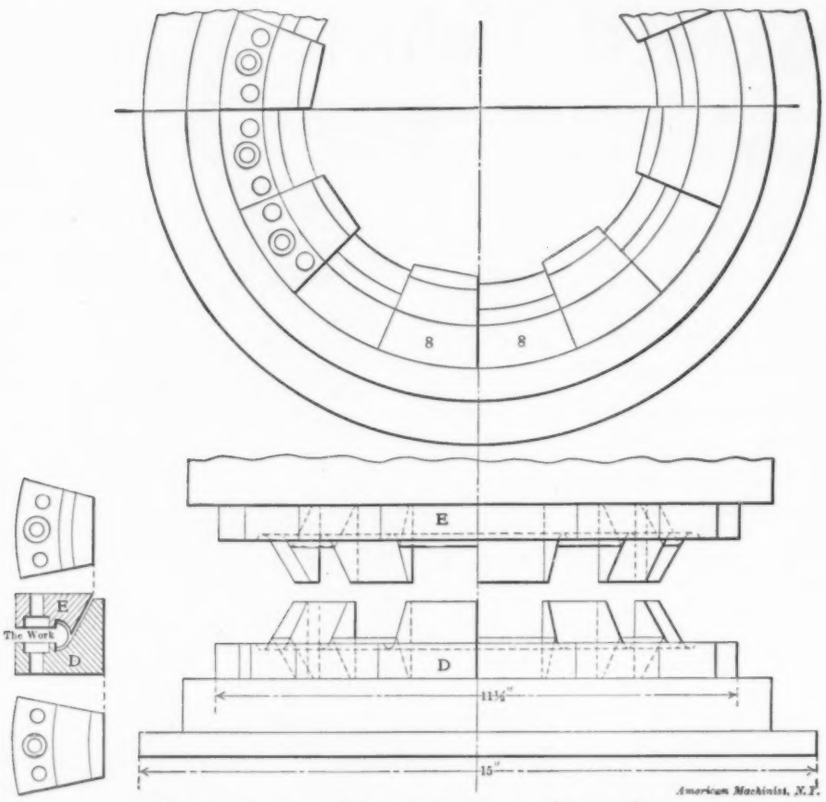


FIG. 2. DIES FOR FORMING GROOVE IN WHEEL RIM

to a stiff V-section. The assembling of the hubs is carried on, as shown in Figs. 1 and 5. Several assembling fixtures will be seen on the bench in the latter engraving. In using these fixtures a washer *B*, Fig. 1, is placed in the fixture, six arms are dropped into place on this washer, their location at the right distance apart being determined by notches in the fixture, the flange *C*, Fig. 1, is then placed over the arms and the wrench *N* which the boy holds in both hands, as shown in Fig. 5, is placed over the arms or spokes and given a twist to force them under a series of spring clips, which hold the entire group together ready for welding. The arms and the flanges as thus held together will be seen at *O* in the fixture, inclined on the bench with the spring-holding clips plainly shown at the front.

ELECTRIC WELDING MACHINES

The machines for electrically welding these groups of parts are shown to the left in Fig. 5, the tables being adapted to receive the assembling fixtures and locate the work correctly without loss of time. Here the parts which are to be welded rest on copper contact shoes immediately beneath the point where the weld is to be made; the ram of the machine is brought down to bring the upper contact point against the work, the current is applied and the weld made very quickly. As is customary in electric welding, the current is cut down to a very low voltage, 3 or 4 volts, but is of high amperage. After the hub flange and arms have been welded together in this way, the ears on the flange are bent over, as seen at *P*, Fig. 1, and this spider which constitutes one side of the wheel, is then ready for fitting on the hub and into the rim.

PUTTING HUBS AND SPIDERS TOGETHER

To assemble the spiders on the hub, the spider is placed concave side up in the fixture, the hub forced down through the hole in the hub flange at the center of the spider, the second spider placed the opposite side on top of the hub and pressed into place, the outer ends of the hubs being crimped later to hold the spiders firmly. The outer ends of the arms or spokes are placed in this operation against either side of the depressions formed inside the wheel rims as explained in connection with the press tools, shown in Figs. 3 and 4.

The assembled wheel ready for welding is then placed in the automatic machine, shown in Fig. 6, where it rests in the fixture illustrated in Fig. 7. This fixture is provided with six indexing notches about the periphery, and the advance of the work under the vertically reciprocating member which carries the upper contact point is accomplished automatically, as are all of the movements which are required in passing this wheel through the welding machine. As the ram descends bringing

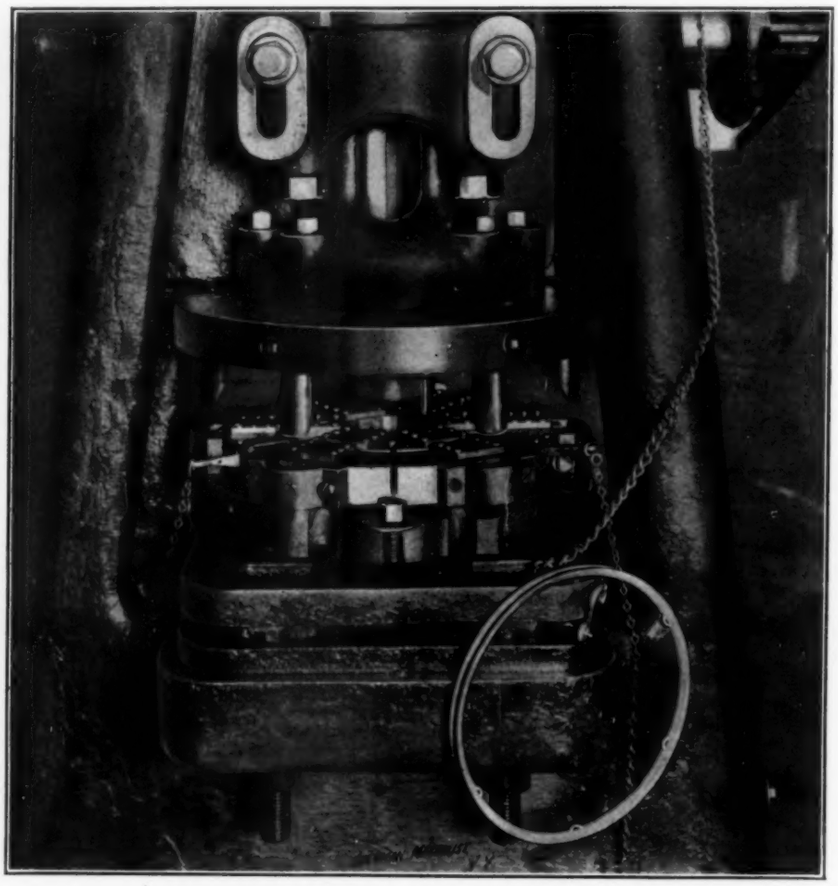


FIG. 3. PRESS TOOLS FOR PUNCHING RIMS

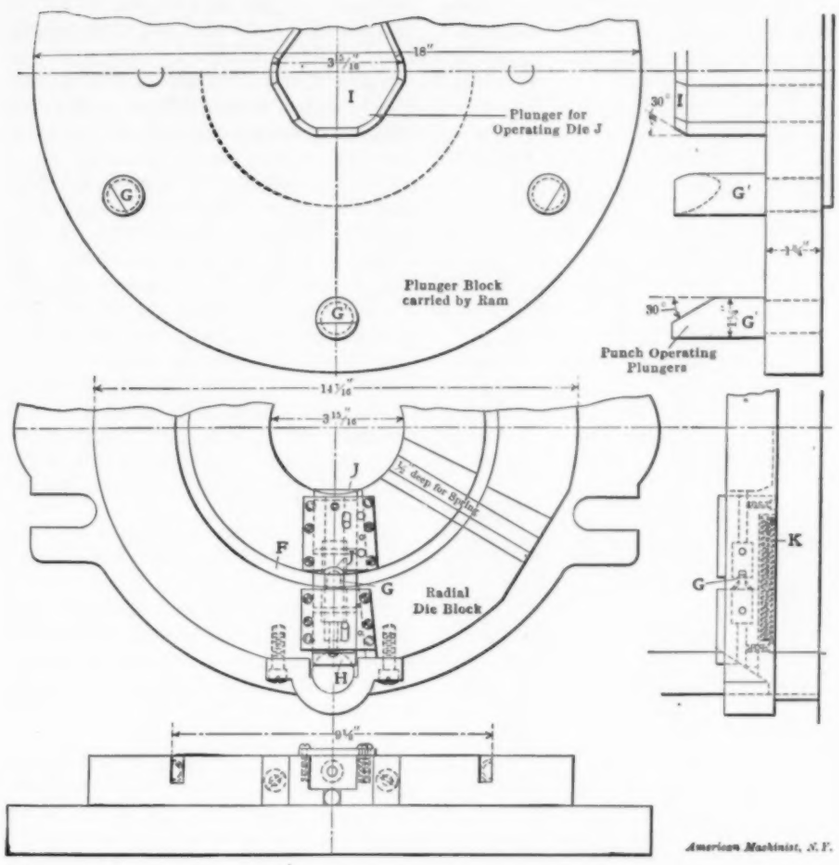


FIG. 4. PRESS TOOLS FOR PUNCHING RIMS

the upper contact point upon the work, the current is automatically applied and the circuit again broken upon the ascent of the ram. The machine works quite rapidly, operating at the rate of some 50 or 60 strokes per minute, and a neat and substantial joint is formed at the end of each pair of arms. Upon the completion of each wheel it requires but a moment to remove the welded wheel and secure another in the fixtures.

The fixture for holding the work while it is being welded is shown clearly in Fig. 7, and it will be noticed that the arms of the wheel pass between fiber insulating blocks and rest upon ⅜-inch copper plugs. Fiber strips 1/32 inch thick and ½ inch wide are also attached to the wall of the holding fixture, as plainly indicated in the drawing, and the interior of the rim of the wheel rests against these strips when dropped into place on the fixture.

As a final illustration Fig. 8 is presented, showing a few thousand assembled wheels, and rims, spiders, etc., either finished or passing through the process of manufacture.

In a test made to determine the strength of these electrically welded wheels, a truck mounted on four of them was loaded up to 1400 pounds, the load being made up of four men and a number of iron castings. The truck with its load was then hauled about the shop, and only by the effort of the men jumping up and down on the truck was it possible to cause

FIG. 5. ASSEMBLING THE WHEELS

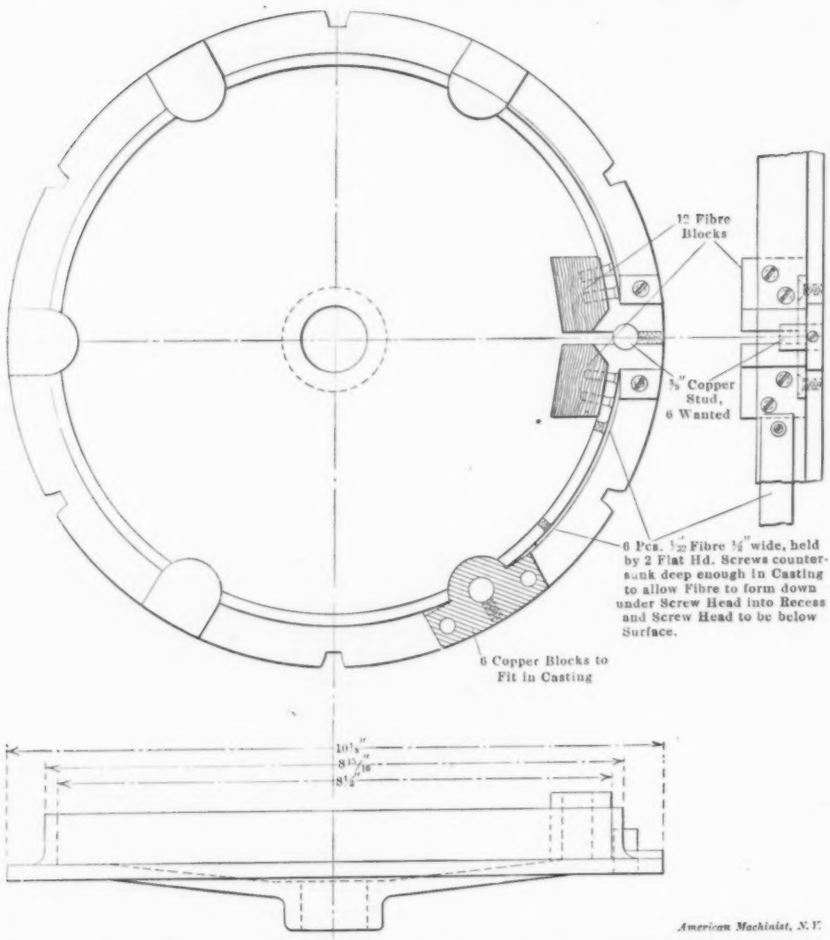

12 Fibre Blocks
⅜" Copper Stud, 6 Wanted
6 Pcs. 1/32 Fibre ½" wide, held by 2 Flat Hd. Screws countersunk deep enough in Casting to allow Fibre to form down under Screw Head into Recess and Screw Head to be below Surface.
6 Copper Blocks to Fit in Casting
10½"
8 15/16"
8½"
American Machinist, N.Y.

FIG. 7. FIXTURE USED IN WELDING WHEELS

any buckling in any of the wheels, and even when the wheels were finally sprung out of shape no failure occurred in any of the welded joints.

The various tools illustrated in this article were constructed by the Nestor Manufacturing Company, 40 West Thirteenth street, New York City.

Trade School Teachers and Costs

BY E. H. FISH*

The most common remark of visitors when they go away from the Worcester Trade School—and we are a most visited school—is something like this: "It is all very nice and you are doing good work, etc., but, BUT, the town we come from never would give *us* the money to do it with." Now this is all very complimentary to Worcester and allows me to say that we are proposing to show the Worcester men who have built up the Middle and Western States that the old town is going to keep them going some to keep ahead of us, but as a matter of fact I do not believe that it is necessary to go at the proposition in a wholesale way. In fact at one time, when things political were looking dark for the establishment of the school, I was nearly ready to try it alone without any money at all.

We have been fortunate here in having money enough to buy five times as much land as we need even now, and to build twice as large a building as any conservative man would have deemed necessary for a start. We have been unfortunate in having it known that we had money to spend. As a consequence we have had a continual struggle to get 100 cents worth for a dollar and the outright gifts that we have had have been so few that we have no possible chance of ever forgetting the donors. The very fact of having a large capital invested makes it necessary for us to do other things, especially the taking in of students in a larger way than is really good for the healthy growth of a school.

ADVANTAGES OF SLOW GROWTH

A small school, say with 20 boys, could work out carefully many problems that we have to face for immediate decision and that we know ought not to be decided for all time by that hasty method. A school with 20 boys can be run with two instructors.

If run on the half-time plan it would require the use of a recitation room, which should be also fitted as a drafting room. If the Lynn plan of having one boy teach another is followed the machine-tool equipment may be small. While

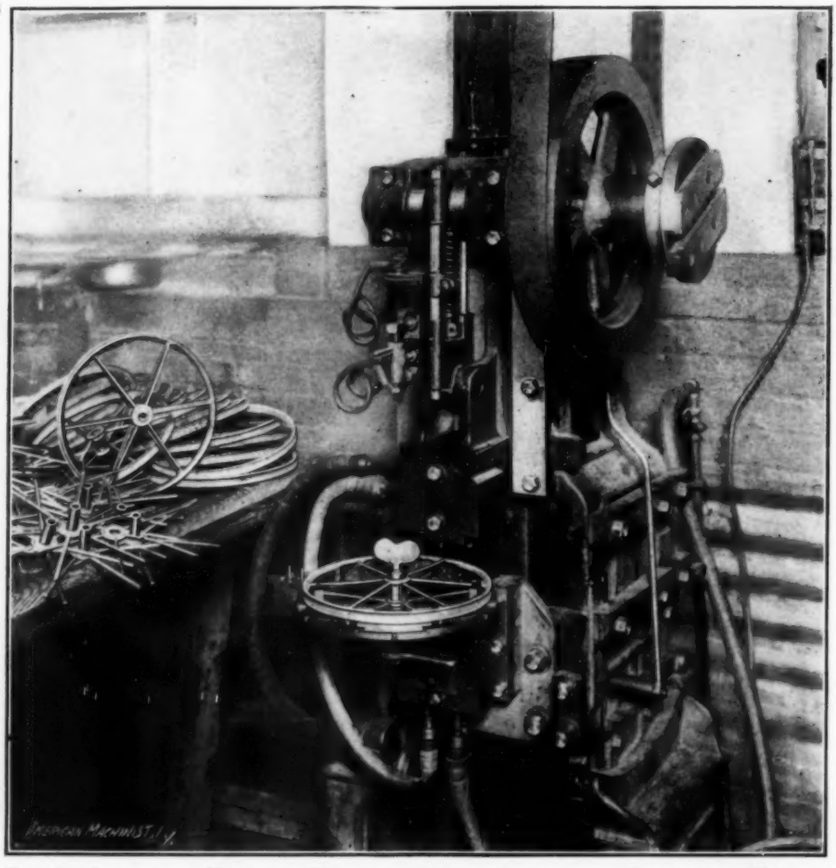


FIG. 6. AUTOMATIC WELDING MACHINE OPERATING ON THE ASSEMBLED WHEELS

*Manager, Worcester Trade School.

I do not have unlimited faith in the Lynn method, it is certainly very much better than trying to get along with toy machinery. There would be need of 3 engine lathes 12 to 18 inches swing, one to have a turret fitted to the bed to interchange with the tailstock; one universal miller—a vertical attachment would be handy and a universal attachment still more handy; a planer—22 inches by 6 feet is large enough; an upright drill—24 inches at least; a drill grinder, an arbor press, a reaming stand, a dozen vises and a small equipment of small tools, which would be enough to start out with. Four thousand dollars will cover the whole thing and put up necessary benches if the boys do the work.

A Plan to Start a Trade School without Money

If you have less than $4000 why not get the local manufacturers to help out? Tell one man that what you want to do is to take his next apprentice boy for him. Tell him that you want to borrow the lathe that he was going to put the boy on. He can be made to see that if you will take the work into your school that he was going to have the boy do in his shop, he can afford to rent the tool to you and take his pay in finished work.

Of course, if you had a barrel of money to spend he would want his share but knowing you have not, he ought to be able to see an ultimate profit in your plan. You can let him pick the boy if you like and you can let him largely pick the work he is to do, though if your school is public you had best watch out for the boy's good. The shop atmosphere of which we read so much, gets so thick at times that it is better for the boy to thin it out a trifle by eliminating such ancient devices as keeping a boy at one job till long after he has it letter perfect and crowding work at the expense of accuracy. Such things are found in shop atmosphere, but that is the very reason why a school with the best of the shop spirit and the best of the school spirit combined should make itself felt.

You will be surprised from the very start to see how much equipment the boys can make. They can just as well begin their shop course before a machine comes in. In fact the setting up of machinery, the building of benches, and all the details of getting a business running is something that is worth more to the boys than any other two months of their lives. Then you can make your own mandrels, fit up your tool room, make spare lathe centers, taps, etc. It may seem that making a tap is no boy's job, and it is not, but each single operation can be performed by a boy if the instructor looks sharp and takes the finishing cuts on the threads himself. It ought to be possible to borrow some standard size rings from local shops, and grind plugs to fit and then rings to the plugs and then as an object lesson try the rings to the standard plugs.

The cost of maintenance must necessarily seem high, but most of our visitors seem to put less stress on that phase of the question than on the first cost. Two instructors can readily handle 20 boys. The output from that number of boys ought to pay all expenses very soon after the start, with the exception of the instructors' salaries and the rent of the shop and recitation room.

The size of shop will depend on many considerations. If the idea is to run for a year in temporary quarters, with borrowed equipment in order to demonstrate to the city fathers that there is a demand for the school, then it would be desirable to use as small a room as possible. The machines suggested can be put in a space of 30x40 feet and still have plenty of space for office, tool room, stock storage, etc. Classes could almost be held in the office, but a room 15 feet square in addition to the shop would be desirable. Rents, of course, are very variable in different localities, but it would seem that, in any city that would be likely to start a school on so small a scale, this space could be obtained for $400 per year, including all necessary power, heat and light.

Fig. 8. View of Wheel Parts, and Assembled Wheels

Trade-school Instructors

What to pay instructors is a serious question. The temptation would naturally be to cut the salaries low. Assuming that there is no one available who is willing to give a dollar's worth of service for 50 cents in cash for the good of the cause, I would suggest that $1500 is none too much money to attract the kind of men that will make the thing go. They will have a hard year's work because they will have to work out each for himself some scheme or method of instruction that will fit the particular conditions under which they work. They will find that handling boys is nerve-racking work, and yet a man with no nervous sensibilities is useless as an instructor. The man who takes the classroom work will find his hands equally full.

If he is a reformed school teacher anxious to fill the place as it should be filled, I have every sympathy with him, and if he succeeds I will wager that he takes no recreation and little sleep during the year.

If he is a mechanic with a common school education and a desire to add to his own knowledge, as well as teaching others, then he will have a better likelihood of success, but no more recreation or sleep. That is, I believe that a shop man can sit down evenings with a book to better advantage than a school man can stand up to the lathe. It must be conceded that for the man who can train himself to expertness in both parts of

the work, shop and school, there are likely to be larger openings in the future than the past has seen. The investment of time will be worth while even if only a salary of $1000 can be obtained at first.

On the other hand, a man who has not approached a salary of $1500 is to be looked on with suspicion as not likely having shown sufficient executive ability in commercial work. It certainly takes more executive ability to handle a dozen boys in a shop, where there is no wage earning to act as a brake, than it does to handle twice as many skilled men. It will take better men in a small school because they will have to be the whole thing, manager, superintendent, cost clerk, stores clerk, janitor and office boy, all in one or two men. In a larger school one man may so make his plans that less expensive men can do the actual work.

Cost of Trade Education

This then leaves us with an expense for maintenance of two $1500 salaries and $400 for rent, and the rather broad statement that the earnings of the shop can be relied on to cover all other expenses. These other expenses with us are averaging about $60 per boy actually in the shop, per year, at which this little school would have $600 to meet. The boys, if they work 40 hours every other week for 48 weeks, put in a total of 19,200 hours, which hours would each only have to be worth 3⅛ cents to meet the bills. We have had very few jobs that have netted us so little as this, so it will be seen that we are safe in assuming that $3400 will carry this 20-boy school through a year at $170 per pupil per year.

This is staggering when we consider that city high schools cost from $50 to $70 per pupil per year and technical high schools and manual-training high schools cost around $100 per pupil per year. This high cost per pupil can be cut by taking more pupils. My belief is that the number per instructor should not be run above 15 in the shop and 25 in the class room. If the cost must be cut I believe that better results can be had by concentrating the work of an instructor on a boy during two years than spreading it over four on two boys. This may seem radical, but I believe that if a boy can be persuaded to go two years in high school by the promise of two years in a trade school, when this time comes with two years greater age, he can be started a long way on the right road toward being a good machinist in that time.

If the object of this 20-boy school is to show the city authorities what can be done, as suggested above, then surely it is better not to take over the 20 boys to two instructors. It is surprising how great a show a few boys can make in a few months, and even though a machinist might see a pile of studs all turned and ground to micrometer sizes and see nothing remarkable in it, some man of less mechanical training will be sure to see in it something wonderful. The nonmechanical man does not realize that the work is merely mechanical. He associates machine work with hand work in his mind without realizing that getting a size on a grinder is only a matter of following rules and that getting a size by hand is quite another thing. In order to make this showing it is necessary that the instructor should be right on the job every minute. In fact, he cannot probably turn out as much work with 10 green boys as he could with less, and certainly not as much as he could alone. If the real object of the school was to make a showing of output only, it could be done by letting the boys loaf and letting the instructor do the work.

It may seem like a rash statement to say that one instructor cannot get a man's work out of 10 green boys, but this is with the understanding that the school is run in the interest of the boy and his future producing capacity rather than his present efficiency. If such men can be had, who can do their best for the boy and get a man's work out of 10, we are looking for them right here in Worcester.

Making Cam for Computing Machine

By C. A. Lindholm

Using a leaf jig for drilling, reaming and facing the steel casting; followed by punching to remove stock from periphery, and finishing with a shaving die which removes about .005 inch of material for final accuracy.

The accompanying sketches show some of the devices used in simplifying the manufacture of the cam *A*, seen in the outline of the jig, Fig. 1.

During the early periods of manufacturing, this cam was made in two parts; that is, a hub was made on the screw machine, having a shoulder on which the cam was fitted and fastened with screws. The cam proper was blanked with a die, flattened in a drop, drilled in a jig, and then profiled to shape in a fixture having a hardened guide. After this operation it was hardened, and assembled on the hub.

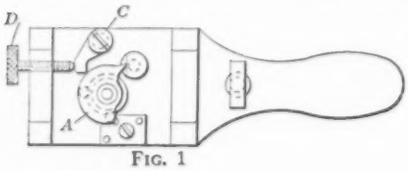


Fig. 1

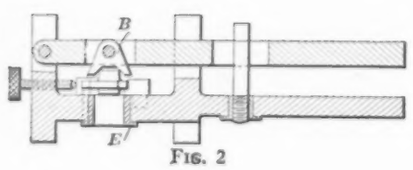


Fig. 2

Figs. 1 and 2. Jigs for Drilling, Reaming and Facing Hub

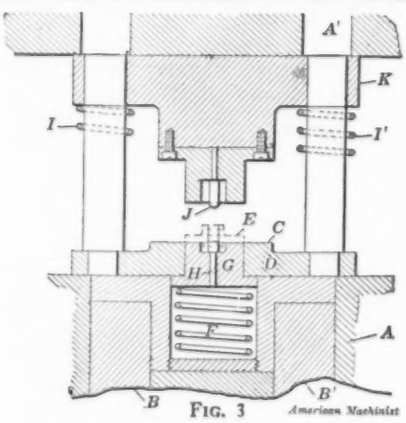


Fig. 3

Dies for Shaving the Cam

This method of manufacturing, besides being expensive, was very unsatisfactory, due to the inaccuracy in profiling the periphery of the cam. Therefore, a simpler and more accurate method was devised by making a steel casting with a hub.

Figs. 1 and 2 illustrate the drill jig for the first operation, and consist of a standard type of leaf jig. The casting is located on three hardened points, and clamped by the floating clamp *B*, Fig. 2. The swinging clamp *C* brings the work up to the positive stops, and is locked securely by the screw *D*. The piece is now drilled and reamed with slip bushings which fit into bushing *E*, and then faced with a collar facing mill.

The next operation is performed in a die which removes the stock from the periphery of the cam, leaving about five thousandths for the shaving operation, which is done with the die illustrated in Fig. 3. This die is of the post type and is operated in a hydraulic press, with the idea of obtaining a slow and steady cut. Excellent results have been obtained in shaving blanks up to one-quarter inch thickness, by this method.

The dies stand up better, and there is less liability of a break in the stock.

Referring to Fig. 3, *A* and *A'* are the base and top of the hydraulic press, and *B B'* the plungers. A casting *D* is made to fit into the press, and fastened to the plunger *B*, and also to the die *C*. The holes for the post are ground after hardening the die, to insure proper alinement with each other. *E* is the cast-steel blank resting upon the shedder *G*, and located on pilot pins in the shedder. The large pin *H* is made about 0.005 inch small and acts as a temporary guide. The pilot pin proper *J*, locates the piece positively as the die moves up to meet the punch.

Springs *I I'*, on the guide posts, are for separating the punch from the die. The punch holder *K* remains stationary, while the die *C* is the moving part, actuated by the plungers *B B'*. *F* is the spring for the shedder and is retained by a nut screwed into the casting *D*. The piece is finally case-hardened. This method of manufacture has proved quite satisfactory and economical.

Tools at the Springfield Armory

By S. B. Redfield

Form milling the warped surface of the Bolo blade.

A combination leading die for a strap box seal.

Dies for inside and outside trimming in one operation; assembling screwdriver parts and forming a shell rivet.

A handy form of lock for drill-rod punches.

In the manufacturing processes at the Springfield, Mass., armory, which has been turning out army rifles and other equipment since the days of the American Revolution, there are many ingenious and interesting special tools and dies employed. A few of these are illustrated in the accompanying sketches.

Figs. 1 and 2 illustrate some unusual examples of form milling in the making of a new product of this plant, that is, the Bolo blade, which has been adopted for the army since its peculiar usefulness was demonstrated by the natives of the Phillipine islands. Fig. 1 is the operation of milling the cutting edge to shape before grinding, and although not nearly so interesting as the next step, it is the preliminary operation to that shown in Fig. 2.

As will be seen by Fig. 1, two blade forgings *A*, which have been flat milled upon one side, are clamped against two blocks *B*. The two blocks *B* are part of the swinging table C, which is hinged at *F*. Underneath the table *C* is a cam plate *D*, which rests upon the cross bar *E*, the latter being bolted by means of angle brackets, to the longitudinal table of the milling machine. Table *C* is free at the left-hand end to be raised or lowered vertically, but is guided at the sides by two upright posts, one of which is shown in the drawing.

It will now be clearly seen that as the milling-machine table is traversed crosswise under the cutters, the swinging plate *C*, carrying the work, will be allowed by cam *D* to drop down and gradually rise again, so that the two milling cutters shape the outline of the blades of the two forgings. At the right of Fig. 1 a cross section of the shape of the blade edge as it is milled, is shown, together with a representation of the cutter.

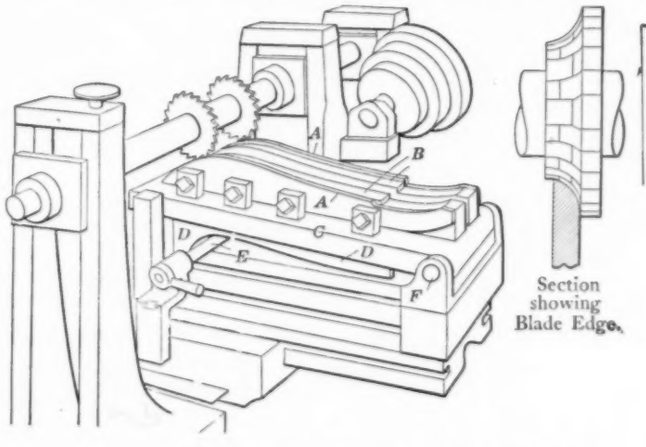


FIG. 1. FORM MILLING EDGE OF BOLO BLADE

DOUBLE FORM MILLING

As intimated, Fig. 2 is by far the more interesting process, as here we have an instance of form milling in two directions, that is, producing a warped surface. At the bottom of Fig. 2 is a diagram of the Bolo blade with exaggerated cross sections drawn thereon. This shows that the blade is thicker at the back than it is at the cutting edge, and it is thicker at a section about ¾ of its length than it is at any other part. This warping is on one side of the blade only, as the other side is flat milled.

To produce this warped surface, the work *A* is screwed down to a block *B*, which is pivoted at each end at *G* in cross blocks *H*. The side surfaces of *B* are turned and are concentric with the pin *G*. The two blocks *H* are held together by two side cradles *C*, which are bored on their inner surfaces so as to conform to the outer, side surfaces of *B*. As this boring is continued for the full length of the two pieces *C*, the ends of the two blocks *H* are shaped to fit these bored surfaces, as shown in the drawing, although the pin *F* prevents *H* from rotating between the two pieces *C*. The pin *F* acts as a hinge to the whole cradle formed by the two pieces *C* and the two cross pieces *H*, carrying the block *B*, and the further end of the cradle is free to move vertically about this hinge *F*.

Under-surfaces *D* of the side pieces *C* are curved as shown, to act as cams so that the Bolo blade shall vary in average thickness, just as was done in Fig. 1 for the cutting edge. Further than this, however, as seen in Fig. 2, at the upper right-hand corner, under the block *B* is a cam plate *L*, which is curved in its length and bears against the hardened roller *K*. This roller *K* is located upon the cross piece *E*.

Now it will be understood that as the slide of the milling machine traverses under the cutter, the cross piece *E*, acting upon the surfaces *D*, raises and lowers the outer end of the main cradle, while the curved cam plate *L*, resting

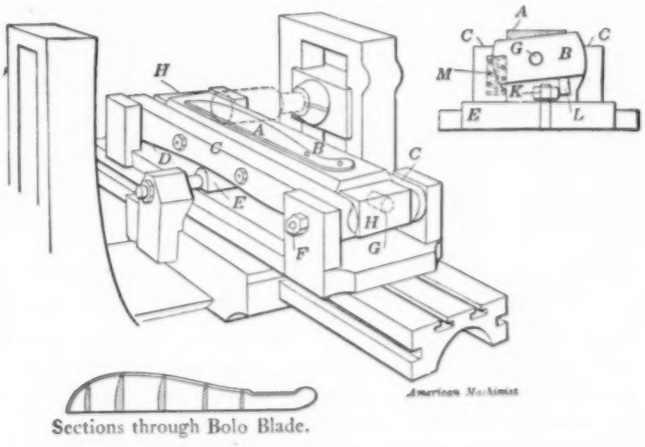


FIG. 2. DOUBLE-MOTION FORM MILLING SIDE OF BOLO BLADE

against the roller *K*, causes the block *B* to rotate upon its two centers *G*, between the side pieces *C*. It will also be seen that a spring *M* resists the action of the cam *L*, so as to cause it to bear firmly against the roller *K*. The double motion thus produced by the two cam surfaces *D* and *L*, produces the warped surface of the Bolo blade desired.

It should be said in passing, that the object of making the blade in this shape is to give it the remarkable balance which causes the weapon to be so effective. Before this process of double milling was introduced, it was, of course, necessary to produce the surface more or less inaccurately by hand grinding.

In Fig. 3 there is shown the operation of form milling the bayonet lug of the upper band of the army rifle. This is the metal band which fits around the rifle barrel at the outer end, to hold it

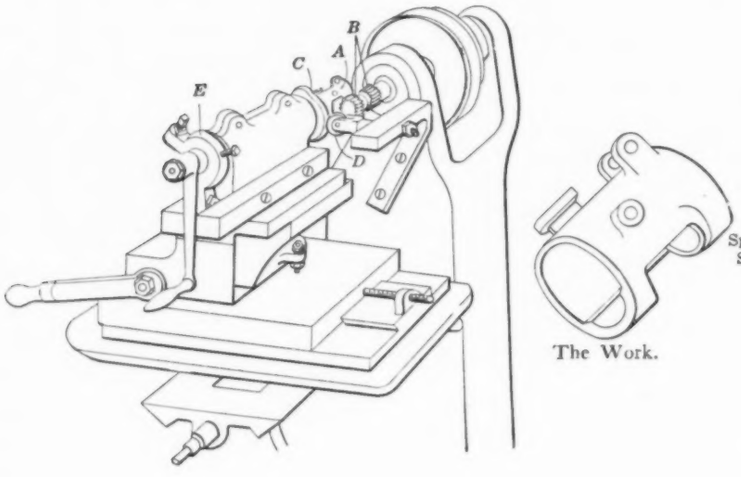


FIG. 3. FORM MILLING UPPER BAND, OR BAYONET LUG

firmly to the wooden stock, and also to form the lug to hold the bayonet. The drawing shows the shape of the piece, and as it is formed by drop forging, it was the former practice to finish the outer surfaces approximately to size by grinding. By means of the fixture shown in Fig. 3, however, it is now possible to greatly increase the production and at the same time make the work accurate.

Glancing at the main portion of the drawing it will be seen that the work *A* is mounted upon a spindle which is turned by the handle at the nearer end. Upon this same spindle is a cam plate *C*, which bears against the roller *D*, which is clamped to the head of the milling machine. A suitably formed cutter *B* is mounted upon the spindle of the milling machine, and the cross slide is operated by means of the handle at the lower left-hand corner. By operating the two handles at the same time, the work is pressed against the cutters, and the cam plate *C* acting upon the roller gives the proper outline and accurate thickness of the piece. The collar *E* carries a number of stop screws so that the operation is carried only through a certain portion of the rotation.

COMBINATION LEADING DIE

It was found some time ago that certain articles of manufacture were rather dufficult to ship, because someone handling the articles liked them too well. This was particularly true of revolvers. Formerly these weapons were shipped in boxes with screwed covers, and over the heads of the screws sealing wax with the official government seal was placed. This was a small obstacle, however, for the man who wanted the revolver simply took a fine saw and sawed the screws off between the cover and the box, removed the contents, put the cover back again and fastened it down with small nails without disturbing Uncle Sam's seals.

To put a stop to this practice the strap seal, one of which is shown in Fig. 5 was devised, this being made of sheet steel. The tool for stamping these out of the sheet is shown in Fig. 4, this being a combination leading die. As will be understood, the sheet metal is fed from the near side of the die, and two operations take place at once. The first operation is by means of the punch *A* and the die *H*, which blank out the flat, serrated plate, without turning up any of the points. The spring scrap stripper *C* frees the punch *A*, while the mechanical knock-out *E* pushes the work out of the die. Proper relief of the die, as shown, holds the punched-out piece in the scrap, and by feeding forward it is carried over the punch *B*, which in combination with the die *K*, bends down the ends to form the outer prongs, and the punches *F* and dies *D* cut and bend at the same time, the six inside prongs which are shown in Fig. 5. As before, the spring scrap stripper *C* frees the punch *B*, and the mechanical knock-out *G* pushes the work out of the die and off the punches *F*.

TRIMMING INSIDE AND OUTSIDE

Trimming both inside and outside at the same time, is done by means of the die shown in Fig. 6. This is for trimming the drop-forged lower-band swivel, which is also shown at the left of the same drawing. Die *A* and inner punch *B* are integral and slide in the yoke *D*. This yoke *D* is provided with rods *F* and *E*, which are continuations of the rods *F'* and *E'* carrying the cross yoke *M*.

Two set screws *G* in the yoke piece *D*, extend through elongated holes in the cylindrical die *A*. Sliding upon the inner punch *B* is the stripper *C*, which

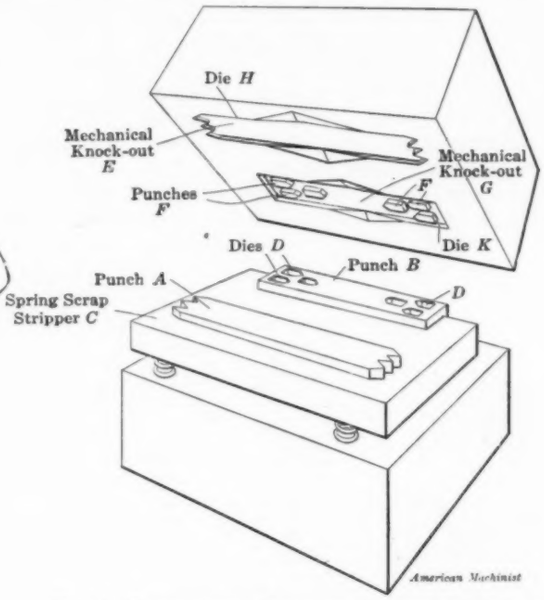


FIG. 4. COMBINATION LEADING DIE FOR BOX SEALS

is prevented by the set screw *S* operating in a keyway in *B*, from falling out. The two set screws *G* extend beyond the edge of *C*, so as to hold it down in the operation of raising the die *A*.

Stripper *J* is carried by the two pins *K*, which extend below the bolster *N* far enough to be struck by the cross yoke *M*, when the latter is raised by the rods *F* and *E*.

Having placed the forging upon *J*, above *H*, the upper die *A* is forced down by the press, removing the outer flash by means of the inner edge of *A* and the outer edge of *H*, the stripper *J* sinking down out of the way. At the same time, the punch *B*, acting with the inner edges of *H*, removes the inner flash of the work, thus trimming it on both edges in one operation.

When the press head is lifted, the cylindrical die *A* rises until the lower ends of the two elongated holes strike against the two set screws *G*, causing the latter

to raise the yoke *D* along with *A*. The yoke *D*, by means of the rods *E* and *F*, pulls up the cross piece *M*, striking the two pins *K*, raising the flash stripper *J*, and freeing the punch *H*. In the operation of raising *A*, the stripper *C* is brought against the two set screws *G*, and held down, pushing the work out of the space between *A* and *B*.

Punch *H* is part of the block *L*, and the latter being bedded in the bolster *N*, there is no relative movement of these parts. The inner flash is forced down through the opening in *H* and drops out through *L* and *M*.

FIG. 5. STRAP-BOX SEAL

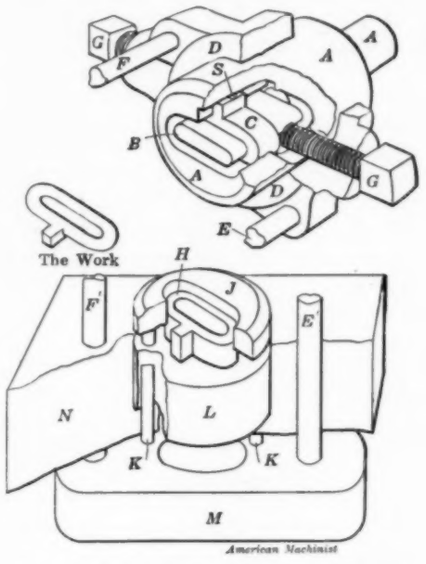


FIG. 6. DIE FOR TRIMMING INSIDE AND OUTSIDE IN ONE OPERATION

ASSEMBLING DIE

Problem solvers are always of interest. One of these is shown in Fig. 7. This is a pair of dies for assembling the screwdriver shown in that drawing, and at the same time locating and forming the shell rivet to hold the two parts of the screwdriver together.

Assembling, which is the first operation, takes place in the die *D*. The two portions of the screwdriver are located in the slots in this die, and set with the larger portion of the spring pin *A* extending through the holes in the two pieces. The shell rivet, whose form is shown, and which is made on an automatic screw machine, is then set over the upper, small end of the spring pin *A*, which is the right size to fit the hole in the rivet. It will be understood that there is only one spring pin *A*, the upper smaller portion being solid with the lower, larger portion, the small end fitting the hole in the rivet and the large, lower part fitting the holes in the screwdriver parts. The two posts *B* and *C* simply hold the outer ends of the work, to keep it from falling out of the assembling die.

Punch *H* is adjustable by means of the screw threads shown, so that when it descends it pushes the shell rivet down through the holes in the two parts of the screwdriver, the spring pin *A* dropping down with it, to just the point where the rivet is equally distributed on each side of the work. This is done so that the rivet heads will be the same size on both sides of the finished screwdriver.

After the rivet is thus accurately located in the work, the latter is transferred to the die *E* which is mounted upon springs and guide pins, as shown. In the center of *E* and held in the bolster, is the stationary rivet punch *G*. When the top punch *F* is brought down the shell rivet is squeezed between *F* and *G*, the block *E* and the work dropping down on the springs to accommodate the crushing of the rivet. A well formed, evenly distributed rivet is the result.

It will be understood that in operation, one descent of the press head operates upon two screwdrivers, that is; die *D* assembles one set of parts, while die *E* finishes the set assembled by the previous descent of the press head. Before the use of these assembling and riveting dies, much difficulty was encountered in properly distributing the rivets in the work. Sometimes the greater portion of the rivet material would be on one side, and sometimes upon the other side of the screwdriver, and no uniformity was attained. All sorts of schemes were tried, including spinning of the rivet, but the final solution was accomplished only by the dies shown in Fig. 7.

LOCKING STRIPPER

In the operation of punching the holes in the butt plate, or metal plate which fits upon the end of the rifle stock which is rested against the soldier's shoulder, great difficulty was encountered by bending of the work. This trouble was overcome by means of the die shown in Fig.

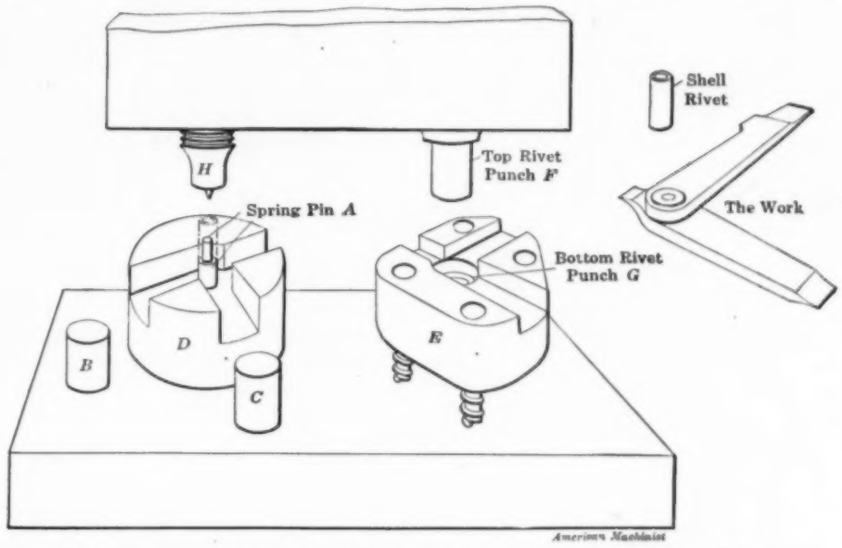


FIG. 7. DIES FOR ASSEMBLING SCREWDRIVER, AND FORMING SHELL RIVET

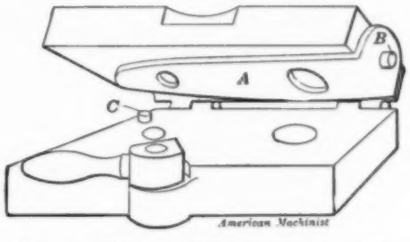
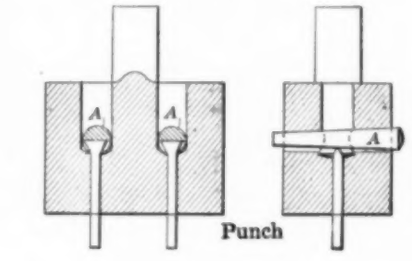


FIG. 8. HINGED STRIPPER TO PREVENT BENDING OF WORK



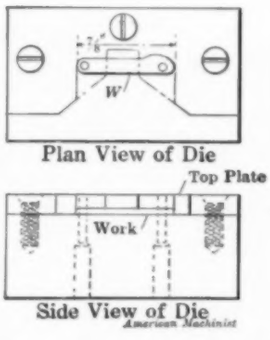


FIG. 9. PUNCH AND DIE FOR BOLT-STOP SPRING

8, which is provided with a hinged cover and cam latch to hold the work *A* rigidly, while the punching takes place. Locating pins *B* and *C* accurately place the work, and it is found that by this device all bending is avoided.

Holding Small Punches

Punching holes of very small diameter in very small work, is shown in Fig. 9. The work *W* is known as the bolt stop spring, and is about ⅞ of an inch long. As will be seen, the two drill-rod punches are guided by the top plate of the die, while the work is held between this top plate and the die proper. The dash-dot lines in the plan view of the die show the shape of the top plate. By means of this style of die, holes 0.050 inch in diameter are punched in tool-steel stock 0.052 inch thick. Furthermore, the holes are exceedingly close to the edges of the work.

In the punch shown in this same drawing an ingenious method of holding the drill-rod punches is seen. Half-round wedges *A* are driven into round holes through the punch block, and bear down upon the upset ends of the two drill-rod punches. The object of this is twofold. First, the method of holding is exceedingly simple and punches, when broken, may be changed with extreme ease. Furthermore, when it was attempted to hold both punches by the same locking piece, it was found impossible to make the upset portion of the two punches exactly the same hight. This would always mean that the longer upset portion would bind first, and leave the shorter one loose, so that, in raising the punch to pull it out of the work, the sliding of the short one very quickly resulted in breaking off the upset head, allowing that punch to drop out. By holding the two punches independently by the two simple wedges, all of this trouble has been obviated.

In this particular instance the drill-rod punches are hardened and tempered the full length. The object of this is to prevent the otherwise soft upper portion of the punches from bulging under the punching blow, resulting in very objectionable binding of the punch in the holder.

How Would You Do This Work?

By Frank C. Hudson

Most of us are daily confronted with the problem of handling certain work with the machines in hand and often feel handicapped because we cannot select such equipment as we would like for the work. But we rarely go further than this, and so miss the experience that a careful study of the problem might give.

In our school days we studied hard to prepare for our examinations and it might be well if we looked into present-day problems in the same way. Instead of spending all our time in criticizing the methods used, it is much better in every way to do a little studying in order to be prepared to say just what is necessary.

Just ask yourself how you would handle a certain piece of work if you had a chance to have things all your own way.

To give a definite problem to solve, the cylinder from a well known automobile is taken, with all necessary dimensions for laying out the tools and fixtures. As the machines and tools selected would vary with the number to be made, we take three definite quantities, as follows:

25 per month,

25 per week,

25 per day.

What machines would be best for boring and grinding the cylinders; boring the valve chambers and seats; facing the base and other flanges; drilling flange and other holes and tapping where necessary.

What would they cost?

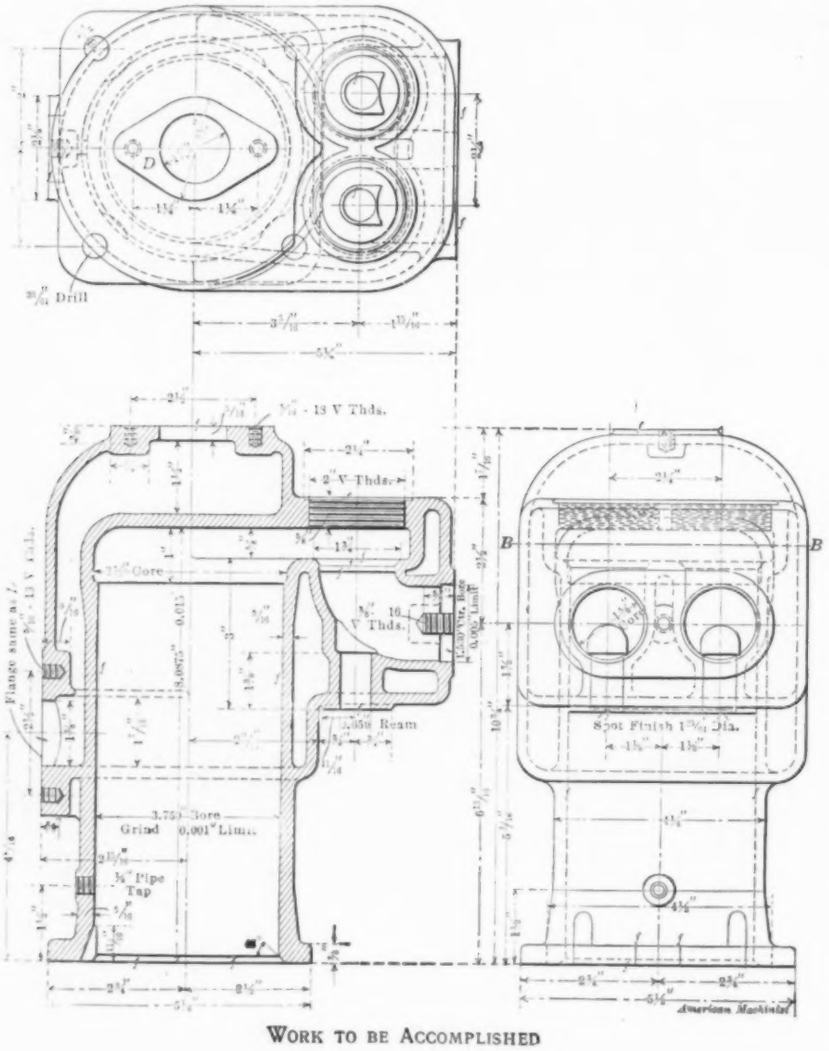
What fixtures and tools would be best and what would they cost?

What would the work on the cylinders cost per piece, under the three conditions named?

Which operation would make the best starting point, and how could the work be located from this so as to perform the other operations to the best advantage?

What would the machines and fixtures probably cost?

There are doubtless many men engaged in this kind of work who believe that they could improve the methods used in their shop. Here is an opportunity to show the rest of us how these methods can be improved.



Work to be Accomplished

Special Tools Used on Injectors

Editorial Correspondence

Special tools used in brass work among which are, a slide tool holder for turret lathes; a bench vise on which to assemble injectors; a special centering clamp that is fastened to the face plate of a lathe, and a handy tool cupboard in which to store turret-lathe tools.

In the injector department of William Sellers & Co., in Philadelphia, the work is nearly all brass, and the injector body is one of the most intricate pieces that a brass foundry is called upon to produce the castings of. Many special tools, jigs or devices are used in their machining, and some of these are well worthy of describing.

Slide Tool Holder

One very useful device is the slide tool holder, as shown at *A A*, which fits the turret of their brass-working lathe. This is made to fit into the turret, and the lever *B* is used to move the slide back and forth. The piece being machined has two tapers. The large end of the taper at *C* is larger than the small end of the taper at *D*; hence the roughing and finishing tools for the taper at *C* are located in one of these slides.

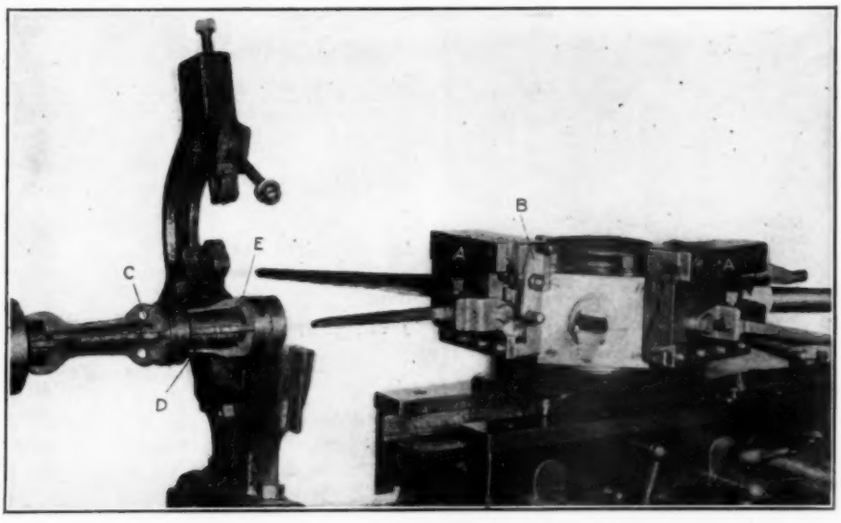


Fig. 1. A Slide Tool Holder for Turret Lathe

When in operation the slide is moved back until it strikes a stop pin, and the tool is then inserted into the opening in the piece being machined. After this the slide is moved forward until it strikes another stop pin, that is set so the hole will be machined to the proper diameter. The holes shown at *C* and *E* are also faced on both sides of the opening, with special tools located in these slides.

In one job that is machined on these turret lathes four slide tool holders are used on an eight-tool turret. A slide tool holder can be used in every other tool hole in the turret. This is a very useful device and is used on many different jobs.

Assembling Vise

In Fig. 2 is shown a very simple form of vise that is used when assembling injectors. While this is a simple device, the injector can be placed in any position desired and held there rigidly while it is being worked upon. The injectors along the bench show a few of the positions in which they can be held.

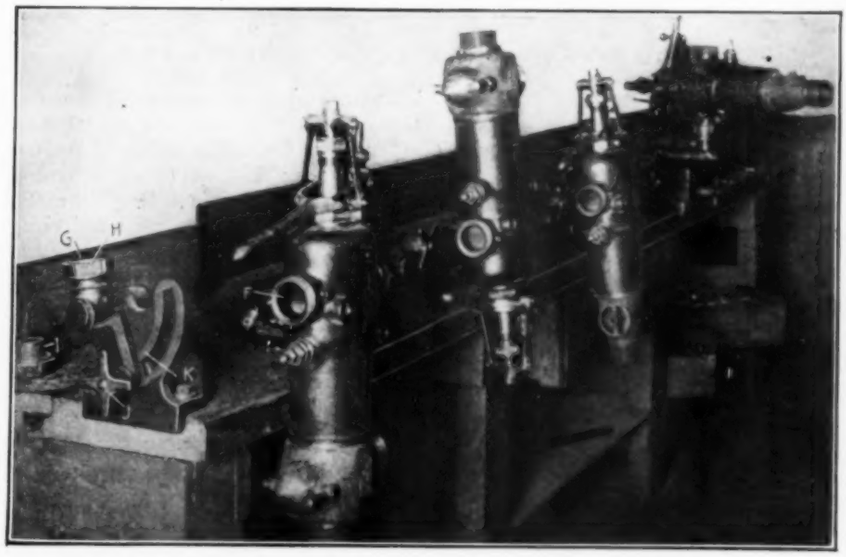


Fig. 2. Vise on Which Injectors Are Assembled

At the extreme left of the bench is shown the vise itself. The bevel in an injector body, similar to that at *F* but on the opposite side, is held on the vise at *G*, while the collar *H* is screwed up to make it tight. This makes a connection similar to that of the universal gas-pipe joint. By loosening collar *H*, the body can be swung around in any position desired, and the collar then tightened to hold the injector body firm. Different sizes of connections, similar to the one shown at *I*, can be screwed into the vise to fit different sizes of injectors.

By hitting the star *J* with a hammer to loosen it, the vise can be tilted in the guide *K* to any angle within its range of 45 degrees. Thus it will be seen that a combination of this tilting and swinging arrangement will allow the injector body to be held in any position or at any angle desired. The star *J* was put on these vises instead of a lever, as it is much easier and quicker to hit it with the hammer to tighten or loosen the vise than it

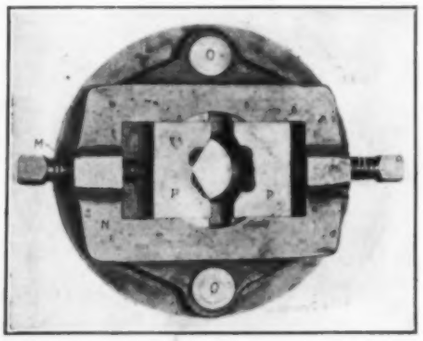


Fig. 3. Special Clamp for Centering and Holding Work in the Lathe

would be to pull a lever around by hand, as is done with the ordinary bench vises.

Face-plate Clamp for Lathe

In Fig. 3 is shown a special clamp that is used for holding work in the lathe. In making this an ordinary face plate L is taken, and a groove M cut across it on the center line. Into this groove the clamp frame N is fitted. It is fastened to the face plate by two bolts, the heads of which are shown at $O\,O$. Sliding blocks $P\,P$ are operated by the screws $R\,R$, to center and clamp the work that is to be machined. When a number of pieces of the same kind are to be machined, the first one is centered. After that the screw R on one side only is loosened to take the piece out, and tightened to put a new one in, thus preserving the center.

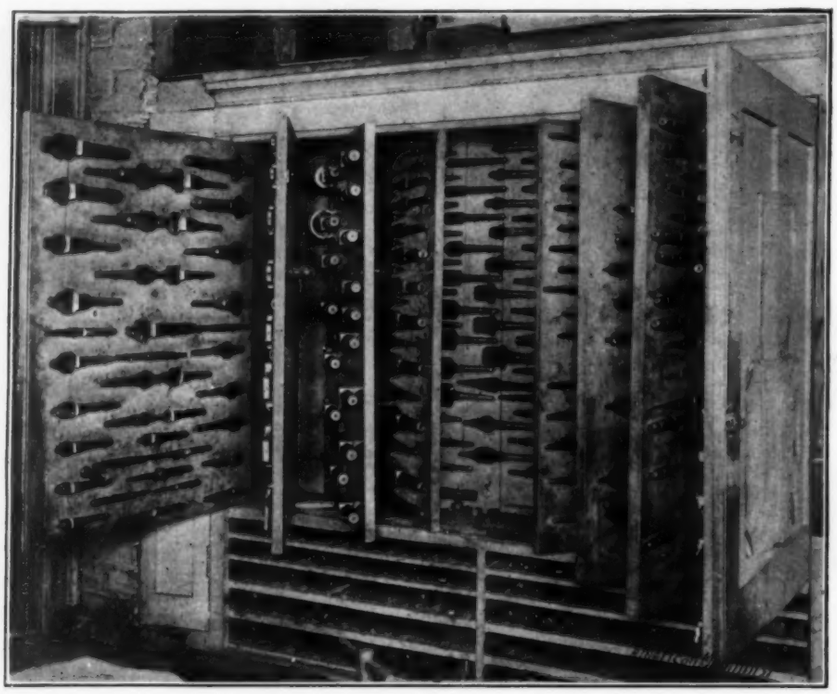


Fig. 4. Tool Cupboard for the Turret-lathe Tools

Tool Cupboard

In Fig. 4 is shown the tool cupboard that this company built for holding their turret-lathe tools. As can be seen, the back of the cupboard is filled with tools that are held up by hooks. In front of this are located in pairs, several boards that are held by and swing on pins located at the top and bottom of their back edge. This allows them to swing open like a pair of doors. Immediately in front of these are located the doors proper.

This gives five surfaces on which tools can be hung in a cupboard of only an ordinary depth. By locating the pins that serve as hinges for each pair of boards on an angle of 45 degrees, they will swing in such a way that they will not interfere with one another. An ordinary door stop screwed into each board near its front edge, as shown, holds them apart the proper distance. By this means a large number of tools can be hold in a very small space, and they are very easy to get at when any particular tool is wanted.

Keys for Shafts

By C. T. Schaefer

In the automobile, especially where the hubs are short (invariably so short as to require close figuring where keys are considered), it is not uncommon to find lost motion in the timing gears due to the short key, or small diameter of shaft. Even flywheels are found with lost motion sometimes, and when this is noted, it is high time to look for a repair shop.

Another place where trouble is sometimes had with keys, is the countershaft of the gear box. The driver of the car coasting down hill, not being a natural born mechanic, does not "feel" the difference in action of the car when being driven by the power of the motor, and when the motor is being driven by the momentum of the car. The shearing of the loose key, by the reversal of pressure, can readily be understood. Let

D = Diameter of the shaft in inches;

B = Breadth of the key in inches;

L = Length of the key in inches;

T = Twisting moment, in inch-pounds;

S_1 = Allowable working stress in shaft, in pounds per square inch, shearing;

S_2 = Allowable working stress in key, in pounds per square inch, shearing.

Then,

$$T = \frac{\pi D^3 S_1}{16}.$$

Example

Let

$D = 1.5$ inches;

$B = 0.3125$ inch;

$L = 2$ inches;

$S_1 = 16{,}000$;

$S_2 = 16{,}000$.

Then,

$$T = \frac{3.1416 \times 3.37 \times 16{,}000}{16} = 10{,}576 \text{ inch-pounds},$$

which may safely be carried by the shaft itself.

If the key is at a distance equal to $Y = \frac{D}{2}$, from the axis; then,

$$T = B\,L\,S_2\,Y.$$

The strength of the key should equal that of the shaft; hence,

$$\frac{\pi D^3 S_1}{16} = \frac{B\,L\,S_2\,D}{2} \text{ and } \pi D^3 S_1 = 8\,B\,L\,S_2 D;$$

Therefore,

$$L = \frac{\pi D^2 S_1}{8\,B\,S_2},$$

for consistent design.

Continuing the example further, we have:

$$T = B\,L\,S_2\,Y = 0.3125 \times 2 \times 16{,}000 \times \frac{1.5}{2} = 7500 \text{ inch-pounds},$$

as all the key will safely carry. This shows that the shaft is stronger than the key in the ratio of 10,587 to 7500. This would not indicate consistent design. It was said that, for consistent design

$$L = \frac{\pi D^2 S_1}{8\,B\,S_2} = \frac{3.1416 \times 1.5^2 \times 16{,}000}{8 \times 0.3125 \times 16{,}000} = 2.8234 \text{ inches}.$$

Thus, we find the key should be nearly 2⅞ inches long, to be equal in strength to the shaft; but, should it be impossible to lengthen the key, as, for instance, in a gear box in which no more than 2 inches can be allowed; then, the remedy lies in increasing the breadth of the key.

If this is not permissible, the diameter of the shaft must be increased to increase Y, and so, the effectiveness of the key. In this case, the strength of the key, while adequate for the work, would be less than that of the shaft by an even greater amount. If the key and the shaft are not of equally good materials, the values taken for S_1 and S_2 must show this difference. If the hub that is keyed on is of different material, again, an allowance must be made accordingly.

If two keys are fitted (usually at 90 degrees), it is best to assume that only one key will have to do the entire work.

as it is not easy in practice to fit two keys alike. The key that fits the better must do all the work, until it deforms enough to allow the other key to go to work. If the second key is not a fair fit, there is no safety in having it there. Anyway, the shaft is weakened, and consistency cannot reside in a two-key job.

The key should also be investigated for crushing on its side faces. If H is the radial depth of key, and S_3 the allowable crushing stress, the moment of resistance to crushing will be

$$T = \frac{H L S_3 D}{4}.$$

Tools for Textile Machines

Special Correspondence

Boring knitting machine stands in the milling machine; gang milling segment teeth; rotating drill jigs.

A problem solver; boring a cam surface forming concave arc of a circle too short and too narrow for end milling.

Some fixtures and methods used in the manufacture of knitting machines are shown in the accompanying drawings. Referring to Fig. 1, *A* is the cast-iron stand of a knitting machine, turned upside down, and the operation shown is the boring of the hole *B* by means of a milling machine.

When the casting comes to the milling machine, the only finished surface is that clamped to the jig plate *D*, which latter is provided with lugs fitting into the slots of the milling-machine table, and also lugs to fit shoulders in the milled face of the casting *A*. It is from this milled face of the casting that the four holes, *B*, *C* and the two opposite them, must be accurately located. This operation was formerly performed in a drill press, and required considerable time.

By the present method the casting is simply clamped down to the jig plate *D*, and so is automatically lined up with the spindle of the milling machine. The first operation is to use an end mill to face off the boss of the hole *B*. After this, the end mill is changed for the boring cutter *E*, and the milling-machine table moved so that the casting is centered exactly opposite the spindle. This is insured by an index mark. The work is then fed toward the cutter, which bores out the hole *B* in the right location and truly parallel to the milled end of *A*

Vertical location of the hole *B* above the end surface is obtained, of course, by dropping the milling-machine table the correct distance, as shown by the index. This done, the table is backed off and then dropped the correct distance, determined by the index, so that the hole *C* is brought down to the cutter. The boring operation is then repeated for hole *C*. The holes opposite are similarly machined on another miller.

Gang Milling Segment Teeth

Milling the teeth in a series of segments is shown in Fig. 2. Half a dozen segment castings, *A*, are swung from the frame *B*, by means of a pin put through the end hole in each; which hole is the axis about which the segments will swing when located in a knitting machine. Cutters *C*, properly shaped to cut four teeth, are mounted upon the arbor of the Lincoln miller, as shown.

Slide *D* is provided with a bolt which runs through the slot in each segment, and by means of three index pin holes in the slide *D*, and one in the casting which holds it, the segments are located in three angular positions so as to cut all the rows of teeth in three operations. The cutters are of the regular Gould & Eberhardt design for cutting several consecutive gear teeth in this manner.

Boring Cam Arc

Fig. 3 illustrates a genuine problem solver. In this figure, the piece *A* is a knitting-machine cam, and on one side, as shown, there is a slot, combined with a concave arc of a circle about the center *D*. The space is too small for successful end milling of the circular arc, and the former practice was to lay it out and then chip and file to the proper size and shape When a large order, involving several hundred of these cam plates, was received, the manufacturers were somewhat appalled at the idea of making so many of these by hand, so that the arrangement shown in Fig. 3 was devised for doing this in a much simpler manner.

Plate *C* is screwed upon the spindle nose of a lathe. Cylindrical block *B* is provided with a taper shank extending

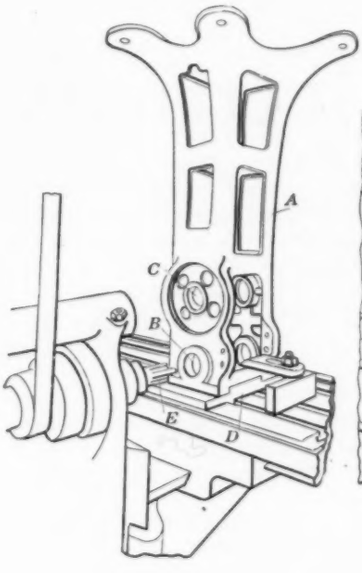


FIG. 1. BORING ON MILLING MACHINE

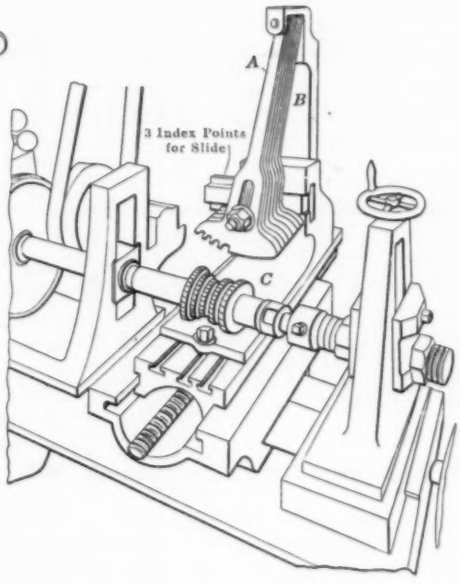


FIG. 2. MILLING SEGMENT TEETH

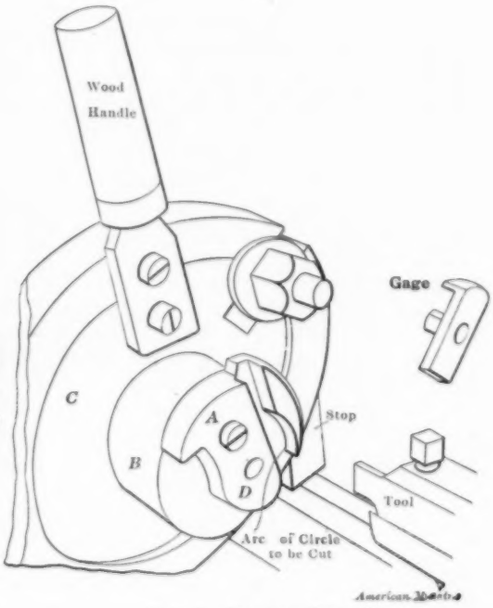


FIG. 3. BORING CAM ARC

into the lathe spindle. Cam *A* with the central hole *D* placed over a centering pin, is then screwed to the face of *B*, as shown. Bolted to the back of plate *C* is a stop, shown in the drawing. The tool is now fed to the work by moving the lathe carriage, and by means of the wooden handle the whole plate and the cam are rocked backward and forward

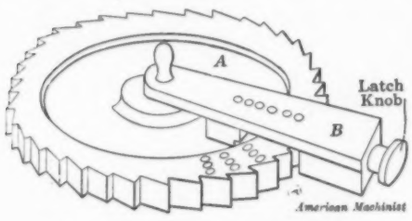


FIG. 4. DRILLING RATCHET WHEEL

by hand, the tool shaving out the small circular arc on each backward stroke, or part of a revolution of the face plate and work. The object of the stop is to prevent the operator from turning the apparatus too far in the backward direction, and thus cutting into the flat cam surface opposite the circular arc. The gage shown is used to determine when the correct radius has been obtained.

DRILLING RATCHET WHEEL

In Fig. 4, *A* is a ratchet wheel, this being part of the knitting-machine mechanism. In its rim, three rows of holes are drilled and afterward tapped for machine screws, these holes being definitely located with reference to the ratchet teeth around the rim; one row of three holes for each tooth.

To determine the spacing, the accuracy of which with reference to the tooth space is not necessarily great, the jig *B* is used. This is provided with a latch operated by the knob shown, the inner end of which fits between two teeth of the ratchet to locate the jig. Then, by swinging the jig around the ratchet wheel, three holes may be drilled opposite each tooth. The other three holes in the jig are for a smaller sized ratchet wheel.

DRILLING THE CAM RING

Drilling the holes in the cam ring of the knitting machine is a work requiring considerable accuracy. This is shown in Fig. 5. *B* is a jig having a center pin *C* to locate it in the hub, and hardened plate *E* is the drilling guide which is located by the arm *B*. Holes A, and the unmarked holes next to these, are for screws which hold the hub to the cam ring, these two parts being separate castings.

In the making of the pieces, the holes *A*, while drilled, are left untapped; while the other unmarked holes are tapped and fitted with screws to hold the two parts together, as they will be in the finished machine. Untapped holes *A* are then used for the locating pin *D*, and by this means the holes in the cam ring are drilled in quadrants, each quadrant starting fresh from a new hole *A*, all of which latter are, of course, accurately spaced by a plate jig in a former operation.

When all of the eight holes in plate *E*

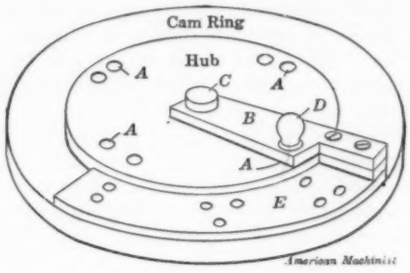


FIG. 5. DRILLING CAM RING

have been drilled through the cam ring, pin *D* is removed and the jig *B* swung 90 degrees. Pin *D* is then located in the next untapped hole *A*, to drill the next quadrant, thus avoiding any accumulation of error in spacing the different sets of holes. Some cam rings are in eight segments, and in that case one-eighth of the circumference is drilled at one jig setting, there being eight untapped holes *A*, for locating the jig.

Hardening Steel with Electricity

By G. C. Kilbourn

A home-made electric furnace that gives satisfactory results.

An accurate and rapid method of determining the proper hardening temperature.

For a number of years I have read articles in the AMERICAN MACHINIST pertaining to the hardening of steel. While these have all been of more or less value to the readers, there is little difference in the methods or processes used.

I have read very little about the hardening of tools, such as form tools, milling cutters, master taps, etc., that are made from high-speed steel. Here accuracy of size and form must be retained and I know that hardeners are still laboring under difficulties with this class of work. The tools become pitted, scaled or come out hard internally with enough of the outer surface soft to allow the tool to become easily and quickly dulled.

In case of pitting or scaling the tools must be sand blasted, or pickled in an acid solution, and either of these operations reduces the size of the tool.

For several years I have used a pack process that was very successful, but slow. The packing material was composed of salt, borax, charcoal, cyanide of potassium and silicate of soda.

The open gas furnace is anything but successful, and a great many are using the barium-chloride bath, but I had never been able to procure a strictly hard outer surface with it.

Some 18 months ago I commenced to experiment with electricity and with a crude home-made furnace I was finally enabled to generate a temperature of 2500 degrees Fahrenheit, and higher if desired, by using carbon plates to line the heating chamber and graphite electrodes.

I operate this furnace on a low voltage, with an alternating current, and stepping down from line voltage to furnace by means of a transformer. Having no combustion in the heating chamber, I am enabled to heat the most delicately constructed tools with practically no distortion. We use raw linseed oil or any thin oil for a quenching bath and bring them out absolutely hard all over, perfectly smooth and clean and free from pitting or scaling. I use a pyrometer to determine the heat and never allow it to go above 2150 degrees Fahrenheit for Novo or Blue Chip steel, which we use nearly always.

With a delicate tool or die I generally preheat it to about 1200 degrees Fahrenheit before placing it into the electric furnace.

We are constantly hearing of costly dies being cracked and broken in hardening that are made from carbon tool steel. Most of this is due to carelessness or ignorance.

For years it has been the practice to take small pieces from a bar of steel and harden and break them to see the fracture, and thereby determining the temperature at which to harden.

This method, however, is too slow and uncertain, and I am, therefore, using a recalescent outfit composed of pyrometer and a small electric crucible furnace. In the furnace I heat a sample of steel that is attached to the pyrometer couple. At the instant the steel reaches the critical point the indicator or pointer will hesitate, thus indicating the temperature at which tools should be quenched that are made from that steel.

I have not lost a die since adopting this method.

Lighting a Large Iron Foundry

By G. H. Stickney *

Two problems—to light for molding and to light for pouring. As a rule far too little attention is given to keeping the units clean Tests of three groups of lighting units give valuable quantitative data.

*Electrical engineer, General Electric Company.

The artificial illumination of a large foundry presents a variety of interesting problems. The ever-present dust, smoke and gases not only tend to cloud the atmosphere, but form light-absorbing coatings on glassware and reflectors of the lamps, as well as on the walls and all objects in the room. Thus, the flow of light is impeded at every point, even by the non-luminous surfaces of the objects which it is desired to see. This condition not only is wasteful of light, but also makes it difficult to produce an adequate degree of diffusion for the illumination of deep molds.

Fortunately, most of the work done in a foundry is of a rough nature which does not require a relatively high intensity of illumination.

The illumination of a foundry must provide for two principal conditions, namely:

(*a*) Molding,

(*b*) Pouring and cleaning up.

Illumination for Molding

The molding is generally done during the brighter hours of the day and if the foundry has suitable window areas artificial illumination is required only during the dark winter days. However, such days do come and usually during the busiest season of the year, when it would be a serious matter to lose or even interfere with one day's production. Poor illumination means rough and imperfect castings with sand holes, as well as slower work. It is easier to turn good castings out of perfect molds than to spend time and power grinding and patching, and even then producing weaker and ill-appearing castings. The lighting system, therefore, must provide suitable illumination for molding even though it is seldom used for this purpose. Fortunately, although the process of molding requires better light than other foundry work, it is generally carried on when the air is clear and the loss by absorption least.

The light must be diffused enough to penetrate the mold. On the other hand, it should have enough general direction to bring out contour. I have seen artificial illumination in a foundry so flat that one could scarcely distinguish a plane surface from a curved one or even see the line where two plane surfaces met. The surfaces of sand in a mold, being dull and granular, are particularly hard to identify under flat illumination.

The penetration of light in a mold is facilitated by insuring that the predominating light is projected at a steep angle, although not necessarily directly downward. This favors the use of a lighting unit with a photometric maximum about 60 degrees below the horizontal. Such a unit should be hung as high as circumstances permit.

Illumination for Pouring

The illumination required for pouring and cleaning up the foundry is less exacting, although nevertheless important. The illumination must be such that the hurrying workmen can find the way quickly in the smoke-filled room. With hot iron under foot and perhaps a crane ladle overhead accidents are liable to occur. An adequate illumination is not only necessary from a humanitarian standpoint, but actually a good investment. Ordinarily the light necessary for molding will provide ample illumination for cleaning up. It is well that the quality of the illumination be either white or yellow so as to suffer least absorption by the smoke in the air, and at the same time illuminate the dull neutral surfaces.

A Common Fault—Lighting Units not Cleaned

I have observed the lighting in a large number of foundries and found one fault prevailing almost everywhere, namely, insufficient attention to the cleanliness of the lighting unit. All practical lighting units transmit their light through glass and most of them require reflectors to distribute the light most effectively for particular requirements. In any foundry a dust film forms quickly on these surfaces and cuts off a considerable proportion of the light. In a recent case a number of lamps were run about six weeks without disturbance and then illumination measurements made before and after cleaning the glass and reflecting surfaces. The tests showed that approximately 50 per cent. of the light was being lost on account of the dirt.

One of the most effective ways of improving a foundry lighting system is by establishing a regular and systematic practice of cleaning globes and reflectors. The accumulations are usually dry and easily removed with a dry cloth. If necessary soap and water should be used. Nowhere else can so great an economy be made in a lighting system with so little effort and expense. In fact the very trivial nature of the cleaning seems to give rise to the thought that it can be done any time and as a result it is neglected. A regular routine should be established to insure proper attention on schedule time. With arc lamps this can, of course, be combined with the trimming.

Selection and Arangement of Units

The selection and arrangement of lighting units in a foundry depends to a considerable degree on the dimensions and arrangement of the building as well as the size and quality of the castings produced. In some classes of lighting it is difficult to decide whether general illumination or localized lighting gives the best results for the least cost. Foundry lighting has, however, almost invariably proved a case for general illumination. As few units as are consistent with even distribution should be placed high, and equipped so as to distribute the light downward.

Extension cords cannot usually be used to advantage except possibly in connection with bench or machine molding. The wear and breakage are usually very high, and exposure to abrasion of insulation and grounding of the circuit is excessive.

Another feature of illumination affecting the problem of foundry lighting is glare. A glaring or brilliant light in the eyes not only reduces the effectiveness and usefulness of an illumination, but actually may be harmful to the eyes. In the past this factor has been generally neglected, while the adoption of more and more brilliant illuminants has aggravated the condition. Now, however, the importance of this factor is becoming recognized so that in the future practice, installations are likely to provide sufficient diffusion.

In considering the question of glare it is important to note that the direction of the light has an important bearing. A highly brilliant light 40 or 50 feet high is not likely to produce any harmful glare, while an ordinary small lamp in the ordinary range of vision may be quite objectionable.

There is at present no measure used in practice by which to establish the procedure in any particular installation, and since diffusion is generally obtained at the sacrifice of some light intensity, the degree of diffusion adopted is compromised between cost of lighting on one side and the acuity and comfort desired on the other.

The Quantity of Light

So far we have omitted to consider the quantity factor, which is generally the most discussed element of a lighting problem since it affects the cost so di-

rectly. Moreover, it is capable of measurement and of a more exact determination than the other characteristic factors of illumination and is, therefore, easier to deal with. The intensity to be supplied in any lighting installation depends on many considerations. This is partly due to the fact that it is possible to see with a fairly low illumination, although it is possible to see better with a higher illumination. With the higher illumination workmen can work faster and produce a better grade of work than with a lower illumination, everything else being equal. One of the principal questions to determine in planning a lighting installation is how far the improved results warrant the increased cost.

The practice in iron-foundry illumination varies from ¼- to 3-foot candles, depending on the size of the castings produced. For small complicated castings the intensity may run somewhat higher. Having decided upon the intensity required, it becomes necessary to determine the number and capacity of lamps required to produce the desired illumination. This may be approximately calculated from photometric curves, but actual data from installations are more practical guides. A demonstration and test of this sort were recently made in the large iron foundry of the American Locomotive Company at Schenectady. Some of the figures from these tests, showing the performance of the 6.5-ampere direct-current luminous arc (magnetite) and the 6.5-ampere direct-current (Boston) flame arc, are included herein so as to give an idea of the relation between the foot candles of illumination and the watts per square foot.

The building consists of a high central bay flanked by two lower side bays. The tests were made in the central bay, which is 560 feet long by 75 feet wide. This is divided into 28 cross bays by the roof girders, the lower chords of which are about 40 feet from the floor. The lamps in test were suspended above the traveling crane or about 39 feet above the floor. Installations of each type were made so as to illuminate nine cross bays or an area of 13,500 square feet. Measurement of the illumination was made at five stations similarly selected so as to give a fair idea of the mean illumination under each group.

While tests were made on two other types of lamps those reported herewith made the best showing. They are as follows:

1—Group of 6 luminous (magnetite) arc lamps, 110 volts, 6.5 amperes direct current, equipped with (Boston type) clear globe and 40-inch inverted steel diffusers. Lamps were hung in two rows 8 feet each side of the center line of the building. The lamps in each row were 60 feet apart and alternating with lamps of opposite row.

2—Group of 5 vertical carbon (Boston) flame arc lamps, 110 volts, 6.5 amperes direct current, equipped with opal globes and 40-inch inverted steel diffusers. Lamps were hung in two rows 8 feet each side of the center line of the building. The lamps in each row were 60 feet apart and alternating with lamps of opposite row.

3—Group of three vertical carbon-flame lamps same type and equipment as group 2. Distance between two extreme lamps 120 feet.

In connection with the test on the luminous arc lamps, the writer calculated the mean foot candles for the same stations from photometric test. This gave a mean value of 1.38 foot candles or about 8 per cent. more than shown in the illumination test with clean lamps. The lamps tested in photometer room took about 7 per cent. more watts than the average in the foundry test. Making allowance for the difference in power, we have a remarkably close check between the photometric and illumination tests.

The tests bring out the high efficiency of the flame arc lamp. In connection with this lamp, however, we have to consider the higher cost of electrodes and more frequent trimming as compared with the luminous arc, which to a considerable degree tends to neutralize the difference in operating cost. Even then the vertical carbon-flame arc makes a very good showing. In order to reduce the labor of trimming it has been proposed to extend a telepherage cable lengthwise through the foundry, with a sling seat to carry the trimmer to the lamps, thus avoiding lowering the lamps or interfering with the cranes.

The tests further illustrate the loss in illumination which may be expected from lamps in foundries, if allowed to go a long time without cleaning. While on first sight this may appear to be an extreme case, it is no worse than are frequently encountered in good foundries.

In this foundry large locomotive parts are cast; all molding is done in the day time so that no comments were obtained on the illumination from that standpoint.

One foot candle was ample for cleaning up, and no difficulty was encountered at 0.6 foot candles, although it was not considered quite enough.

GROUP 1—6 LUMINOUS ARC LAMPS.

Date.	Volts* Line.	Watts* per Lp.	Total* Watts.	Watts per Sq. Ft.	Mean* F. C.	Remarks.
Apr. 25	107	678	4068	0.302	1.28	Lamps clean.
May 9	107	660	3960	0.294	1.18	
May 17	108	669	4014	0.297	1.12	
June 2	107.5	636	3816	0.282	0.59	Lamps very dirty
June 2	107.5	658	3948	0.293	1.28	Cleaned—Lamps retrimmed.
Average	.....	...	....	0.294	1.09	

GROUP 2—5 VERTICAL FLAME ARCS.

Date.	Volts* Line.	Watts* per Lp.	Total* Watts.	Watts per Sq. Ft.	Mean* F. C.	Remarks.
June 2	104.5	648	3240	0.240	2.56	Lamps clean.

GROUP 3—3 VERTICAL FLAME ARCS.

Date.	Volts* Line.	Watts* per Lp.	Total* Watts.	Watts per Sq. Ft.	Mean* F. C.	Remarks.
June 2	105	677	2031	0.160	1.48	Lamps clean.

*From actual measurement.

LOG OF LIGHTING TEST IN FOUNDRY OF AMERICAN LOCOMOTIVE COMPANY, OF SCHENECTADY, N. Y.

Length of Pulley Hubs

Will some manufacturer of pulleys kindly explain why his concern does not include in its catalog, more dimensions of the pulleys manufactured besides diameter, width of face and bore. The designing engineer nearly always has use for all dimensions, particularly length of hub. In places where the pulley must be located close to a bearing, it is almost impossible to locate either pulley or bearing accurately if the length of the pulley hub is not known.

Catalogs always give length of bearings but few give the length of hub and some other dimensions of pulleys.

In some special designs it is necessary to know the thickness of rims, number of pulley arms, etc. Catalogs containing these dimensions are even more scarce than those giving length of hub. Manufacturers of power transmission machinery should give the designing engineer and his draftsmen, data necessary for properly placing their pulleys. It is a matter of business for surely the designing engineer will specify pulleys whose dimensions he can be sure of.

And while this dimension matter is up, another kick may be registered. It is time the length of set collars and their thickness and external diameter be specified.

Education of the Apprentice*

Special Correspondence

A plea for the incorporation of industrial training in the public-school system and a suggestion for a course that should attain highly satisfactory results.

*Abstract of a paper by J. J. Flather read before the National Foundrymen's Association, Chicago, Ill.

This paper discussed the various methods in use for securing an ample supply of skilled labor and urged that employers and school boards get together and organize industrial departments and trade preparatory schools as a part of the public-school systems. Professor Flather stated that the general introduction of manual training into the schools would not meet the requirements, as it is not sufficiently intensive to be vocational.

With few exceptions the time devoted to any one subject does not exceed 250 actual hours, and when one considers that it requires from 8000 to 11,000 hours for a boy to learn a trade and that he may put in 250 hours in four or five weeks, it can be readily seen that the manual training of our schools can have little weight as a preparation for vocational work. It has, however, one marked advantage, in addition to those mentioned, and this is the opportunity afforded teachers and parents, as well as the boy, in helping to determine whether or no an industrial career should be followed.

Pupils Drop Out at Eighth Grade

The speaker showed that over 48 per cent. of the pupils who enter school drop out before the end of the 8th grade, that is at 12 to 14 years of age, and no manufacturer or other employer wants a boy so immature physically and mentally as a 12- or 14-year old boy.

Undue loyalty to democratic ideals has prevented our school boards from differentiating their courses to any marked degree, and the attempt is made to put all pupils through the same general studies. In the commercial and business world we soon discover that all men are not equal and we must also recognize the same conditions in the status of our school children and make provision accordingly. Here in the city of Chicago today nearly 50,000 children are "repeaters" who are spending the second or third or fourth year in the same grade, and at a cost in actual outlay, of over two million dollars per year. Special provision should be made for the education of backward and defective children and strong industrial courses should be established for those who are not attracted by the purely academic studies, but who do evince an interest in manual work.

Professor Flather urged that manual training be taught in all the elementary schools, and that at the end of the 6th grade, corresponding to the age 12 or 13 years, separate courses be established—the one, as at present arranged for professional and commercial training, as well as the higher technical training, leading to and through the high school; the other having in view the industrial training of the pupil. Bearing in mind the class of boys it is desired to interest and develop, and the object to be attained, practical work should predominate, but during the 7th and 8th grades, that is, the first two years, the training should be general and not specific. In order to keep the boys busy, inasmuch as there would be less preparation of studies, it would seem desirable to require that 7 hours a day be spent in the school, of which time at least 4 hours should be devoted to practical work under skilled workmen.

Two additional years would follow this industrial-preparatory, and these should be trade-preparatory, in which the time spent is devoted to some one definite trade, to the end that by judicious and intelligent training the boy may enter some industry where he will be given an opportunity, at fair wages, under an apprentice instructor to finish the trade begun in the preparatory trade school. In this school, which a boy enters at 14 or 15 years of age, the time could well be increased to 8 hours a day with 4 hours on Saturday and there seems no good reason why the practical work should not be continued for eleven months of the year. An important feature of this course would be the coöperation of an advisory committee, consisting of representative men selected from the leading industries of the locality.

Finishing the Trade

The amount of time required to finish a trade would be reduced very materially under such a plan, and it is safe to say that the hope of early reward would encourage many a boy to hold out and complete the entire school course instead of quitting as at present. It is not to be expected that all such boys would become skilled tradesmen, but it must be admitted that the training could well be adapted to prepare all boys who might desire to enter industrial pursuits and by a process of selection and elimination, those best qualified by natural endowment and otherwise, could be trained as all-around men for the trades, while others who did not give such promise of development would be trained for some special work.

It is recognized that no universal system of trade education will be generally applicable to every community; local conditions will suggest and demand modifications, and we should expect in certain localities to find emphasis laid on the teaching of trades required in the industries which predominate in the vicinity.

In working out the course of study for such industrial education it should be constantly borne in mind that some of the boys who enter upon industrial training will reach a time in their lives when they will want to keep on with their studies and enter a technical college. Provision for such boys must be made by a modification of the high-school course with this in view, and if necessary, the college entrance requirements should be changed.

While the problems involved are many and far reaching, it is confidently believed that the interest and coöperation of employers with school officials will bring about a system of education which will not only benefit the boy and make him a more intelligent citizen, better fitted to fill his sphere of usefulness, but at the same time, American industries will profit because of the mere intelligent and contented body of wage earners which will result from such coöperation.

The Artistic Throb

"You've heard of people who liked to buy books and magazines with uncut leaves, because they took a sort of artistic delight in going through them with the paper cutter, haven't you? It often happens that they never read what is printed inside at all. It is just cutting the leaves and glancing through that gladdens their heart. Well, sir, I know how they feel about it. I have the same thrill once a week. When I get the pay envelop with my pay in it, I know there isn't a cent there that I can have for my own use, yet, do you know, I simply can't help opening the envelop and looking in? It must be the artistic temperament that shows itself, the same as with the booklover. I can account for it in no other way. If I didn't care for the thrill I might just give the envelop to my wife, and let her pay the money out. But the privilege of cutting the end off that envelop and looking in is worth my whole week's work. After all there's nothing like the artistic throb."

An Old English Grain Roll Fluter

By A. Lawrance

An old "home-made" English grain roll fluting machine in which the work is held vertically instead of horizontally and the fluting is done by a number of tools instead of by a single serrated tool.

The line cuts show an interesting home-made machine, for cutting the quick-lead spiral flutes in chilled rollers for flour mills. It has been in use 20 years, but is capable of turning out accurate work and plenty of it.

Fig. 1 shows a side view of one-half the machine; which consists of two independent units, each driven separately, and capable of operating quite independently of each other. Only one cutting head can be used if desired, or one operator can attend to both heads, with assistance when setting the rolls in position. *A* is a vertical column. The screw-driven saddle *B* carries the adjustable bearing *C*, and bottom locating center *D* for supporting the work on its shaft. *E* are two brackets, one on each side of *A*, with planed faces, against which are bolted the gray-iron distance pieces *F*, about 10 feet long, and on which the table *G*, shown in Fig. 5, for carrying the cutting tools, is securely bolted. *H* is a cast-iron worm wheel, also shown in Fig. 5 with the tool-box slides. This worm wheel is cored out in the center and bored, for the work to pass through, and has a turned sleeve cast on the under side, which accurately fits in a hole bored to receive it in each end of the table *G*. *E*, *F* and *G* being securely bolted together. *H* is secured in position by two steel locking rings being screwed on the threaded sleeve, under the table *G*. *I* is a shaft, supported in the two bearings *J*, and carries the cast worm shown, which gears with *H*, and operates the feed gear. When the saddle *B* gets to the bottom of its stroke, the bolt *L*, which is adjustable in the slot *K*, strikes the cranked lever *M*, shown also in Fig. 4. This lever fits on the worm shaft *I*, and carries the pawl *N*, which operates the ratchet wheel *O* keyed on *I*, and thus revolves the worm wheel *H*, which carries the cutting tools. *P* is a weight which drops down on *F*, and puts on the feed, while the bolt *L* returns the pawl *N*, by depressing the lever *M*. This spaces the flutes. *Q* is a cast-iron rack secured to *B*, as shown also in Fig. 2. This rack operates the pinion *R*, shown in Fig. 2, and passes through a slot cut through the top of *A*, to keep it in position. *S* is the shaft which carries *R*, and is supported by the two bearings *T*. It will thus be seen that upon the up and down motion of the slide *B*, the rack *Q* will give a slow semi-rotary motion to the worm wheel *U* (which is secured in position exactly like *H*, and locked by the two rings *V*) through the medium of the change gears *Z*, *a*, and *Y*, at the back, and the shaft *X*, which carries the worm shown gearing with *U*. *W* shows the steel guide bar, with a straight keyway milled down it in which slides the key in *U*, shown in Fig. 2. This key drives the work. *W'* is a special friction coupling for securing the bar which passes through the roller to *W*. The shaft is dropped on the center at the bottom, the roller passing through the hole in the center of *H*. The adjustable bearing *C* steadies the shaft at the top and keeps it perpendicular. A small distance collar is dropped on the shaft between the roller end and the under side of *C*, as shown, to prevent the roller being lifted off the bottom center. A bracket *b* is cast on *A* for carrying the stud for the change gear *a*. The tool slides *c* are cast solid on the worm wheels *H*, Fig. 5. There are eight of these slides on each wheel, thus when both heads of the machine are at work

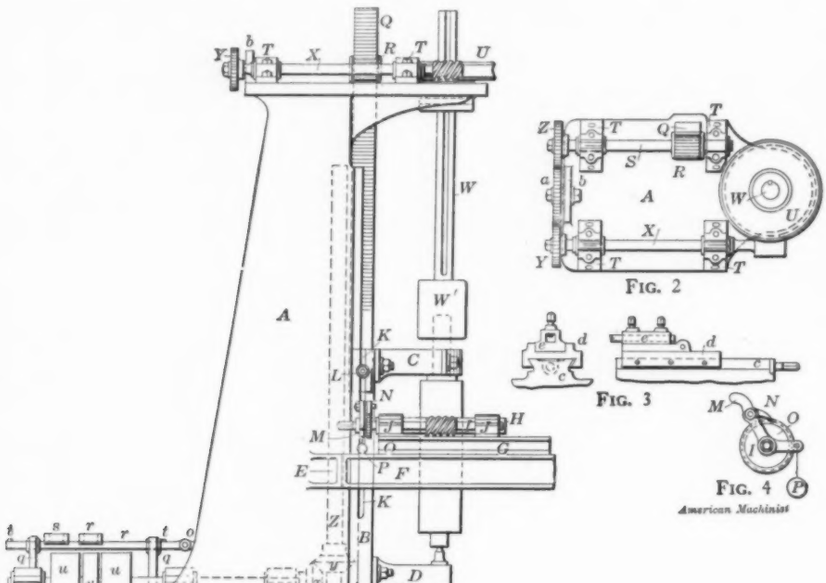


FIG. 1

FIG. 2

FIG. 3

FIG. 4

A MACHINE FOR CUTTING SPIRAL FLUTES IN CHILLED GRAIN ROLLERS

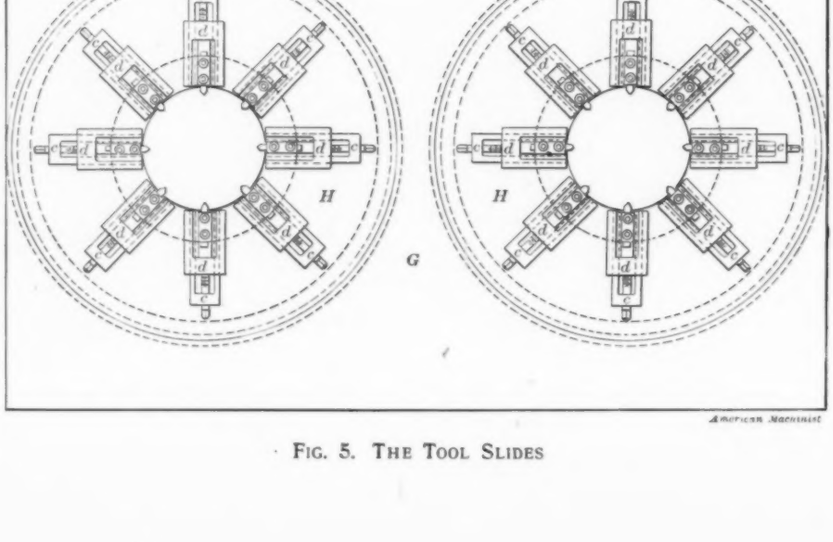


FIG. 5. THE TOOL SLIDES

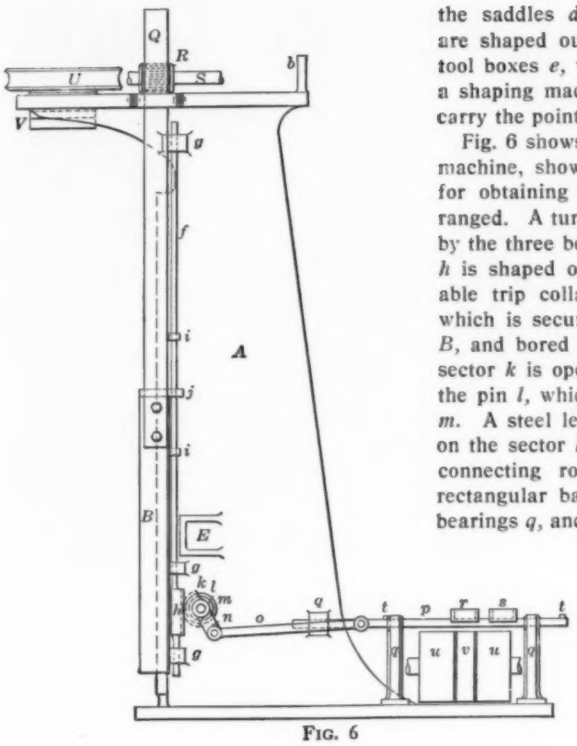


FIG. 6

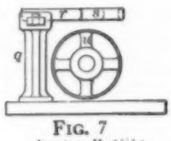


FIG. 7
American Machinist

THE STRIKING GEAR FOR THE REVERSE

the saddles *d*, shown in Fig. 3, which are shaped out to receive the swinging-tool boxes *e*, which act just the same as a shaping machine clapper tool box, and carry the pointed fluting tools as shown.

Fig. 6 shows a skeleton drawing of the machine, showing how the striking gear for obtaining the reverse motion is arranged. A turned steel rod *f* is supported by the three bearings *g*, cast on *A*. A rack *h* is shaped on *f*, and *i* are two adjustable trip collars, tripped by the dog *j*, which is secured on the top of the slide *B*, and bored out to guide *f*. A toothed sector *k* is operated by *h* and pivoted on the pin *l*, which is screwed into the boss *m*. A steel lever *n* is keyed on a sleeve on the sector *k*, and is coupled up to the connecting rod *o*, which operates the rectangular bar *p*, supported in the two bearings *q*, and carrying the cast-iron belt forks *r* and *s*, which guide or ship the two belts over the pulleys, *u* and *v*, of which Fig. 7 shows an end view. The two loose pulleys are marked *u*, and *v* is the driving pulley. There is a crossed and straight belt, of course. A quick return is obtained by having a large pulley on the overhead driving shaft. Two stops *t* are let into *p*, to prevent the belts from being shipped too far.

In Fig. 1, *w* shows the three bearings for supporting the driving shaft, which carries the bevel wheel *x* at the end as shown dotted. This drives a similar bevel *y*, shown on the vertical driving screw *Z*, which is supported by a footstep at the bottom, and a bearing just above the wheel *y*, and one at the top. This screw drives *B* by a long gun-metal nut, the cutting speed being very slow for this class of work. The tools cut on the downward stroke of *B*, and the feed for spacing the flutes is put on when the saddle is at the bottom of its stroke, just as the return commences. The tools, being free to lift, do not cause any friction beyond their own weight. The machine is stopped and started by an adjustable sliding handle on the rod *f*. The man stands on the table *G* when operating the machine. *B* is counterbalanced.

there are 16 cutting tools in operation at once, which is the chief feature of the machine. The slides *c* are planed to take

---

Those interested in the conservation of natural resources will be encouraged by English press accounts on the extension of the Yorkshire coalfields, which indicate that they have 35,000,000,000 more tons of coal available for mining than was supposed.

Grinding a Hole in a Large Cam

The accompanying illustration shows a very interesting job of grinding which recently came to the Heald Machine Company. This shows the adaptability of its cylinder grinder for various kinds of work. This particular job called for the grinding out of a hole in two large cams, weighing about 500 pounds each, and having a hole about 14½ inches in diameter.

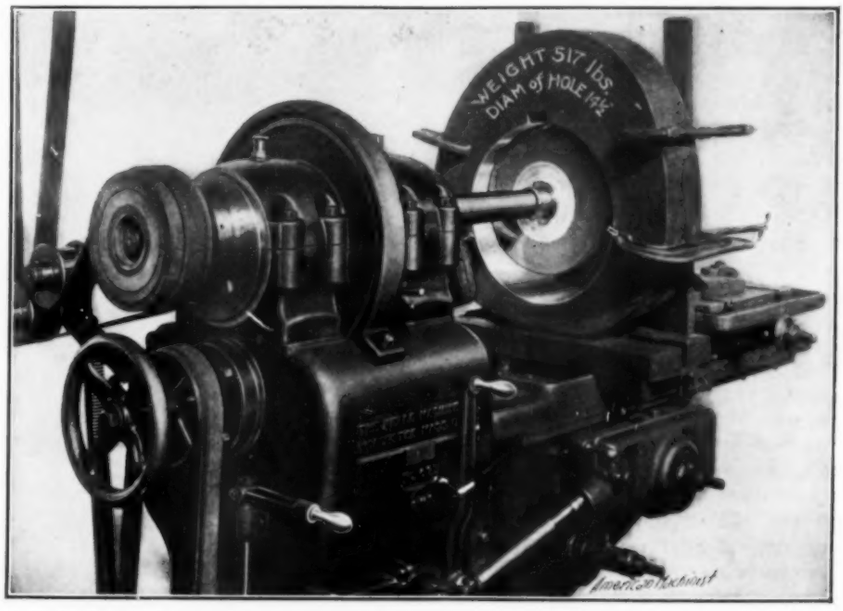
These cams go on a large shaft of a drawing press of massive proportions, and when they came to be assembled at its destination, the hole was found to be too small to allow the cams to go on to the shaft in proper position. About 0.025 or 0.030 inch had to be ground out before they would go into place on the shaft.

These cams were mounted on parallels on the table of a cylinder grinder, and brought into position, so that the hole was parallel with the grinding spindle and also with the travel of the table.

Owing to the large diameter of the hole, it was necessary to secure special large grinding wheels for this, and to mount a large wooden pulley on the left-hand end of the spindle to give the correct circumferential speed to the grinding wheel.

The difference between what is regularly used and what was necessary for this job, can be shown by the difference between the outside diameter of the pulley and the hole, which corresponds to the diameter of the pulley regularly used. That is, this wooden pulley was clamped outside of the regular driving pulley on the machine, as fitted up to use in grinding automobile and gas-engine cylinders.

In this job one element of special interest to the builders is the proof of its ability to illustrate forcibly the fact that this type of cylinder grinder is able to handle more than one kind of work with efficiency and economy.



GRINDING A HOLE IN A LARGE CAM

Manufacturing on the Engine Lathe

By H. M. Wood*

An important development in machine design which enables duplicate or repetition work to be produced rapidly and with a high degree of accuracy upon the engine lathe.

A system of stops and templets by means of which the work is turned to size and to the correct dimensions between shoulders without the application of calipers or other measuring tools after the lathe is set for the first piece.

The speeds and feeds used on some typical examples, and the time saving effected by this method of manufacture.

*With the Lodge & Shipley Machine Tool Company.

The recently developed Lodge & Shipley engine-lathe attachment, multiple stops for length feed and cross feed, has been previously described in the AMERICAN MACHINIST. This mechanism is illustrated in Fig. 1 as applied to a 20-inch patent-head engine lathe. The device consists of an automatic release for the length feed, controlled by five different adjustable stops which can be accurately set in any desired positions and to suit the dimensioned drawing of the parts to be turned, along the bar carried beneath the apron. The length stops determine distances between shoulders; in conjunction with the length stops there is a bar parallel to the bridge of the carriage having five adjustable stops, for determining diameters.

The former description of the stops covered their use with a single turning tool. Since then, what the builders designate as their "connected compound and plain rests" has been thoroughly developed, and is a great time saver when used in conjunction with the regular multiple stops.

The patent-head lathe shown in Fig. 1 is equipped with the connected compound and plain rests. The carriage of this same machine (illustrated in Fig. 2) gives a clearer idea of the construction.

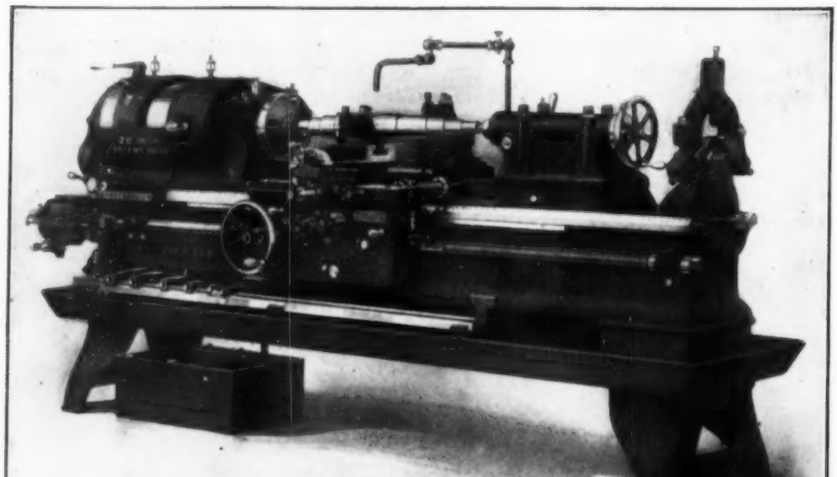


FIG. 1. PATENT HEAD ENGINE LATHE EQUIPPED WITH MULTIPLE STOPS AND SHOWING WORK SET UP

USING THE STOPS

Two sets of dogs are used on the diameter stop bar. The front set of dogs form the stops for the rear tool, and the rear set of dogs form the stops for the front tool. These stops are adjustable to any desired position in the T-slots. A star knob at the front of the apron furnishes a convenient means for rotating the stop bar to bring the different dogs successively into position to engage the lug on the cross slide.

The connected compound and plain rests are of particular advantage in turning shafts having several shoulders. A regular lathe tool carried in the compound rest at the front, does the turning. The rear tool holder carries an inverted squaring or necking tool. As soon as the length feed trips automatically, thus determining the location of a shoulder, the entire cross slide is fed forward. This withdraws the front tool from the cut, and at the same time brings up the rear tool, which squares the shoulder and also necks the part at that joint if the job is to be subsequently ground. The front and rear portions of the cross slide are made separately, and are coupled together by tongue and groove so that the rear tool block and its portion of the cross slide can be completely removed, if desired.

THE LENGTH STOP

When turning successive lots of the same part, it is of further advantage to use a templet or spacing bar (see Fig. 3) for the length stops, instead of the adjustable stop dogs. The spacing bar has in it fixed grooves at the proper distances apart, to correctly locate the several shoulder positions on the piece to be turned. The lever on the apron successively drops into each one of these grooves, just as when using the adjustable stop dogs the lever successively engages each one of the stops. The great advantage of such a spacing bar is that it constitutes virtually a jig for lathe work and insures (without preliminary measuring) that the distances between shoulders on subsequent lots will be exactly the same. When the spacing bar is not in use it can be removed and stored in the tool room with other jigs until again needed.

FIG. 4. ARMATURE SHAFT

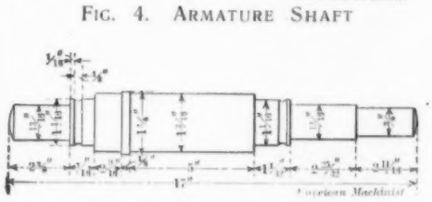


FIG. 5. ARMATURE SHAFT

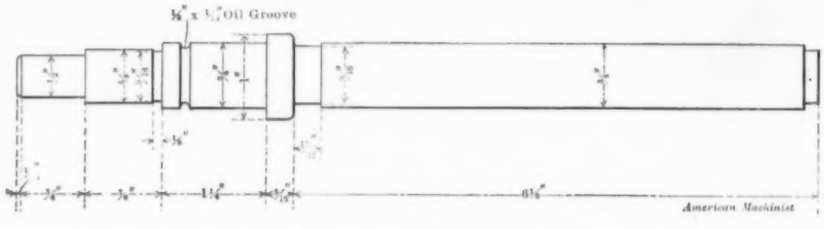


FIG. 6. COMPOUND REST SCREW

FIG. 2. CARRIAGE WITH DIAMETER STOPS AND CONNECTED COMPOUND AND PLAIN RESTS

Accurate work will be turned out on a lathe fitted with the multiple stops, without the services of an expert machinist. No calipering or measuring whatsoever

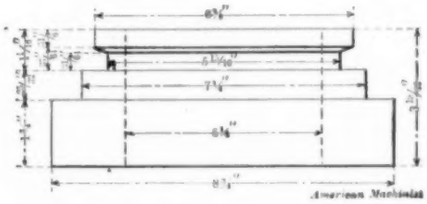


FIG. 9. 24-INCH DRIVING CLUTCH

is required after once making the proper setting of the stops for the first piece of a lot. To make the original setting of both the length-feed and the cross-feed stops for usual jobs requires from 5 to 15 minutes, depending upon the skill of the operator and the nature of the work.

The value of the multiple stops and connected compound and plain rests in the production of duplicate work on a strictly manufacturing basis, is shown by few examples herewith of work done on a 20-inch lathe with these attachments.

MAKING ARMATURE SHAFTS

Fig. 4 is an armature shaft of 0.50 carbon steel, which was turned at the surface speed of 160 feet per minute with a feed of 75 per inch. Two operations were necessary, that is, the piece had to be reversed in the lathe in order to get at both ends. Two cuts were taken over the small diameters at the ends, and one cut over the center of the shaft. All of the diameters, including the recessed portions to give clearance for subsequent grinding, were positively determined by the cross-feed stops. Positions

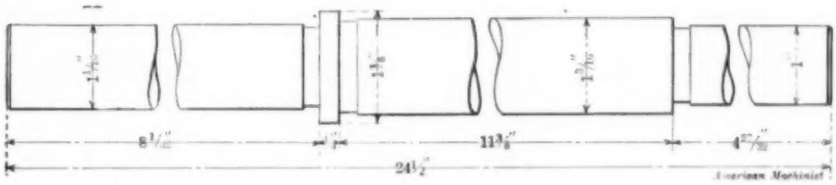


FIG. 7. CHANGE-GEAR SHAFT

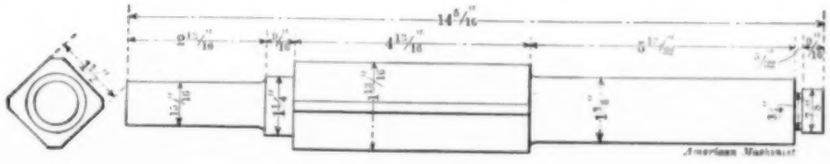


FIG. 8. TRANSMISSION SHAFT

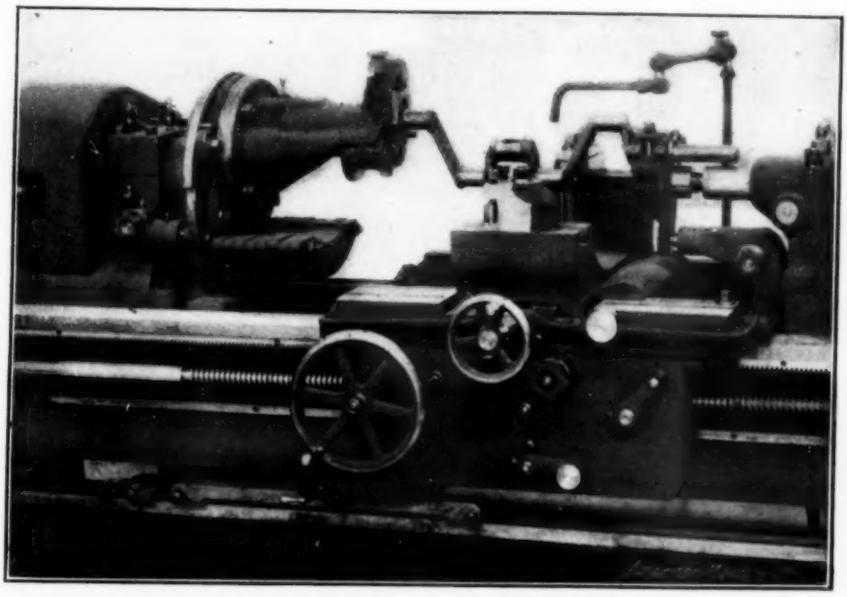


FIG. 3. SPACING BAR

of the different shoulders were determined by the length of feed stops. The turning time, including handling, with 0.012 inch left for grinding was 21 minutes.

Another armature shaft of the same material is shown in Fig. 5. This was turned at 125 and 90 feet feed, 0.012 inch left for grinding, in 10 minutes.

A large electrical machinery manufacturer submitted six armature shafts similar to the above. The average times formerly consumed in turning these six shafts by usual engine-lathe methods were respectively 26, 49, 49½, 47 and 41 minutes. On the lathe equipped with multiple stops and connected compound and plain rests, these turning times were reduced to respectively 12, 20, 20, 26, 25 and 22 minutes each. In other words, in these particular armature shafts, the elimination of hand calipering and measuring saved a little over half the turning time.

Fig. 6 shows a steel compound rest screw which was formerly turned preparatory to threading and grinding in 17 minutes. The use of the multiple stops and connected compound and plain rests reduced the lathe time to 9¾ minutes.

Turning Change Gear Shafts

The Lodge & Shipley Company turned the steel change-gear shafts for their 18-inch lathes (shown in Fig. 7) in 20 minutes each by the best former methods on the engine lathe with compound rest, single turning tool and hand calipering. The shafts are now being turned with the aid of the multiple stops and connected compound and plain rests in 11 minutes each.

Comparing groups of change-gear shafts turned by present and former methods, we find that the shafts turned with the aid of the multiple stops were not only turned much quicker, but also are far more accurate. Therefore, in these tests, the actual saving of 45 per cent. of the former turning time by no means fairly measures the efficiency of the multiple stops. In order to make the time of 20 minutes with hand calipering, a variation of from 0.002 to 0.003 inch in diameters was allowed, and of 0.005 to 0.008 inch in distances between shoulders. On the other hand, all of the pieces turned with the multiple stops are within 0.001 inch of size in all diameters and distances between shoulders.

The transmission shaft turned from a 1½-inch square bar of 0.12 to 0.15 carbon mild steel is shown in Fig. 8. The ends were reduced, shoulders squared and necked as shown, and a cut was taken across the squared portion in the center to round the corners. The turning time completed was 4½ minutes each on a patent-head engine lathe, equipped with multiple stops and connected compound and plain rests.

Chucking Work

The examples above given are jobs which are turned between centers, but the use of the multiple stops is by no means confined to that class of work.

Fig. 9 shows a cast-iron clutch for a 24-inch patent-head lathe. The first operation on this clutch consists of facing the large end and boring. The clutch is then mounted on an expanding arbor against the face plate and driven by a pin fitting a drilled hole in the clutch. For the second operation, the several diameters are determined by the cross stops and the positions of the shoulders by the length stops, the same as in turning a piece between centers. The former time, with hand calipering, was 33 minutes, and turning time with multiple stops 18 minutes.

The foregoing examples of typical work illustrate the savings which have been made by the use of the multiple stops and connected compound and plain rests. It has been found in general that this equipment, by substituting mechanical measuring for hand calipering, has reduced the turning time 25 to 50 per cent. for duplicate parts having two or more shoulders.

An Outline of Lock Development

By E. E. Watson *

A brief extract from a paper on "Recent Advances in the Construction of Fire- and Burglar-proof Safes," read at the Franklin Institute.

*Factory supervisor, Herring-Hall-Marvin Safe Company, Hamilton, Ohio.

The development of the art of building safes for the protection of valuables is interwoven so closely with that of the art of lock building that the two subjects necessarily must be treated together.

It is apparent that a safe, however secure from the standpoint of construction, would be useless without an opening giving free access to its interior, and that opening guarded by a lock at least as secure in point of design and construction as the safe itself.

Locks, as we know them today, and as they have been known ever since they were first used, consist primarily of a bolt and a key for operating the bolt, and some means interposed between the key and the bolt to render the operation of the bolt either more or less difficult or impossible without the use of the proper key.

First, not only in point of simplicity, but naturally also in point of historical origin, is the latch lock, in which there is a bolt pivoted on a fixed point and raised by some sort of key.

Locks were later rendered more secure by the introduction of the warded type in which the introduction of the key into the hole provided for it was rendered more or less difficult by means of interposed wards, making it, to a degree at least, impossible to introduce the wrong key.

This was succeeded by the present-day lever tumbler type, in which tumblers are interposed between the key and the bolt, making it necessary for the key to lift the different tumblers before the bolt can be withdrawn. This type of lock is considered secure in proportion to the number of tumblers used and the means provided for varying the relative amount of lift.

The bolt of this type of lock has fitted to it a member that passes into slots in the lever tumblers in the operation of its withdrawal, and the province of the key is to line up these slots in the level tumblers so that they register with the fixed member of the bolt.

A later development of the tumbler type of lock is that known as the cylinder pin-tumbler lock. In this type of lock the obstruction consists of divided pins preventing the turning of the plug until these pins have been raised to a point where the division line between the different sets of pins coincides with the outer surface of the plug, and the inner surface of the cylinder, in which it rotates. When these points have been so lined up by the introduction of the proper key the cylinder may be rotated and the bolt withdrawn.

The inconvenience resulting from the use of the ordinary type of key lock, by reason of the fact that keys could be wrongfully duplicated, or they might in various ways come into the possession of persons not entitled to them, gave the necessary impetus to inventive genius, and the modern dial or combination lock was the result.

Coincident with the development of the dial lock is that of the changeable type of key locks, in which the arrangement of the tumblers of obstacles may be almost indefinitely varied. It practically, after being set up to a new key, becomes an entirely new lock and cannot be operated by any other key than that to which it is set up.

The development of the changeable-key type of lock is of great importance for the reason that a limited amount of security is frequently needed of a kind that cannot be afforded by the ordinary type of lock. This security is frequently furnished by combination or dial locks that are much more expensive.

The changeable key locks, until recently, have been of a design and construction that were very apt to get out of order and cause considerable inconvenience to the user.

In the case of apartment houses, where tenants are constantly changing, the ordinary type of lock affords absolutely no security, for the reason that keys may be duplicated. With the changeable-key type of lock it requires but an instant of time to set up the lock to a new key and thereby render all previous keys inoperative.

The combination lock as it is known today to distinguish it from the key lock became a necessity when it had been demonstrated that practically all key locks could be picked. This fact was developed in the historic lock controversy of 1851, in England, when Mr. Hobbs succeeded in picking all of the best makes of locks.

A few years later, in 1856, Mr. Linus Yale, Jr., succeeded in picking several of the Hobbs locks. It then became generally conceded that no difference what the obstacles were that were interposed between the key and the bolt so long as an opening was left for the insertion of the key, this same opening provided means for the insertion of picks to raise the tumblers. Mr. Yale then turned his attention to the designing of a lock that could be operated in some manner other than by the insertion of a key, and the early type of combination locks was the result.

The activity of the burglar made it evident that a lock with absolutely no communication with the outside of the protected structure was necessary and essential to security, and the invention of the time lock followed. This was and still is, to a large extent, used in connection with the combination lock. Its use prevents the operation of the combination lock until such time as the time clock has run down and, by so doing, withdraws its obstruction to the operation of the combination locks themselves, or means provided for opening.

Meanwhile, inventive genius had been equally active by the invention of liquid high explosives, the fluidity of which could be increased by the addition of liquefied ether, so that it could be made to flow into the space surrounding the lock spindles or into the joint between the door and the frame. The burglar, without first securing any proprietary rights in the invention, adopted this method and the battle of wits began over again, with the result that the lock makers finally evolved a motor device working in conjunction with a time lock, which made it unnecessary to connect the outside of the door with the inside by means of spindles.

The motor device has not been universally adopted, mainly because spindles can be made so that they cannot be driven in or pulled out, and they can be, and are, made drill proof. They are ground into the doors so closely that no liquid could be forced around them.

A Railroad Educational Bureau

By Dexter C. Buell *

Extracts from a paper before the Central Railway Club, showing the comprehensive plan for training employees in all branches, to be of great value to the railroad and to themselves.

*Director of education.

The Educational Bureau of the Union Pacific Railroad was organized September 1, 1909, with three stated objects in view: To assist employees to assume greater responsibilities; to increase the knowledge and efficiency of employees; to prepare prospective employees to enter the service.

Although the bureau maintains the closest relations with all departments of the road, it has no authority in departmental matters. Its interest in, and dealings with, the employees, are purely of an educational nature. It does, however, offer to *every* employee in the service, who is able to read and write, an opportunity to become better informed about his work, so as to increase his efficiency, and to broaden his ability along new lines, or to enable him to specialize in some new field of railroad work more suited to his ambition and desire.

The bureau can teach *every* employee *something*—can help him in some way.

The idea of educating one's employees is not a new one, although until the Union Pacific started this work, railroad educational plans were outlined for employees in but one or two lines of work—principally shop apprentices, or employees of the mechanical department. All of these educational plans left out of consideration entirely numerous other classes of employees in the service. Many of them made it compulsory on the employees to take up the work. Without exception, these systems proved so expensive, no matter what the results may have been, that their dividend paying possibilities have been questioned.

In organizing the Union Pacific Educational Bureau, it was decided that, if we were to assist employees to assume greater responsibilities, such assistance must be extended to every man in the service that desired it, no matter what his position or occupation might be. It was further decided not to make it compulsory upon anyone to take up this work, and to so devise and operate the scheme as to keep the expense so low that no question could be raised as to the benefits more than offsetting the expense. It was decided that the only way to reach all employees with equal effectiveness and to insure to every man the opportunity of taking advantage of this offer, was to give the instruction according to methods of successful correspondence schools. The strong points and weak points of present correspondence-school methods were weighed; the strong points strengthened, and the weak points eliminated as far as possible.

It was decided that no instruction papers should be issued unless approved by the head of the department interested, and that all educational matter issued by the bureau should deal with Union Pacific practices and methods, thus assuring the student that what he studied and learned through his educational course could be put into practice immediately.

In order to make sure that the bureau's work was being done according to Union Pacific practices, an Advisory Board, consisting of the head of or a representative of the head of, each department, was organized. This board met with the chief of the bureau each week to plan the work, outline the courses, and direct the policy of the bureau. When the course outlines were prepared and divided into subject headings, each subject was assigned to the employee or official on the system who was considered best qualified to write authoritatively on it, and he was requested to prepare on that subject a paper, to be submitted to the chief of the bureau. When a series of papers was completed, the various men who had written these papers were called in to the bureau headquarters, thus forming a committee before whom the papers were read, discussed, and criticized. Following this general discussion, the papers were returned to the writers for such revision and correction as were suggested, and finally sent to the bureau. Such papers usually contained all the obtainable facts relating to the subject treated of, the bureau's work being to arrange these facts in such order that they would be suitable for instructional purposes; to get pictures to illustrate them; to edit them; and to issue them. In keeping with these duties, day by day at the bureau headquarters, the unwritten laws and practices of railroading are being gathered and put into textbooks; existing rules are being systematically compiled, condensed, explained, and illustrated; departmental work is being taken up from the simpler beginnings, and being explained through the various steps to such limits as may seem desirable.

Complete courses are being written on such subjects as there is the greatest demand for. Other subjects or special lines of work, on which information is desired by only a few of the employees, are be-

ing covered by special instructions; or, possibly, by transferring the employee to a department or position where he can gain the information desired through practical work, with the coöperation of the bureau.

A list of the courses offered to employees at the present time may be of interest, and is as follows:

Block Signal Maintenance and Operation; Interlocking; Signaling; Elementary Electricity; Electric Light and Power; Telegraphy; Telephony; Railroad Operation; Train Operation; Station Work; Railroad Accounting; Freight Traffic; Passenger Traffic; Analysis of Statistics; Track Work in English; Track Work in Japanese; Surveying and Mapping; Railway Civil Engineering; Railway Mechanical Engineering; Locomotive Course; Air Brake Course; Gas Engines; Motor Cars and Motor Car Operation; Mechanical Drawing; Sheet-Metal Pattern Drafting; Boiler Construction and Repairs; Machine Design; Refrigeration; Car Building; Car Repairing; Shop Practice and Plumbing and Pipe Ftting.

Other regular courses may be added as demanded.

Special Pamphlets

In order to keep employees uptodate on improvements or new methods, arrangements have been made to issue special pamphlets on any live subject of interest, whenever it is deemed expedient. Such special pamphlets are in a series by themselves and are distributed to all employees interested, whether students of the bureau or not.

In order to take care of students who are deficient in mathematical training, a series of mathematical papers has been specially written to help students over any mathematical difficulties they may encounter in their lessons. For example: A student taking the Gas Engine Course may come across a problem in square root that he is unable to solve. Instead of starting this man on elementary mathematics, and making him take complete training until he reaches and completes square root, an instruction paper of six or eight pages has been prepared on the subject of square root alone, and can be mastered by anyone who can add, subtract, divide and multiply. In the same manner, a paper on formulas has been prepared, and will enable anyone with the barest knowledge of addition, subtraction, multiplication and division, to understand and manipulate any formula met with, either numerical or algebraic.

An important part of the training of all employees is to familiarize them with the property for which they are working. With this end in view, a series of papers has been prepared, embracing the history of the Union Pacific, general information regarding its organization, and the scope of the organization of the various departments, and a geography of each of the States in which its principal mileage is located.

When possible, existing textbooks are used. For example: The mechanical-drawing course of the Scranton schools is undoubtedly as good as can be obtained on the subject, and is used for our work. There are few textbooks, however, that can be so used.

To take care of the eight or nine hundred Japanese laborers employed, from 60 to 70 of whom are section foremen, the track course has been translated into Japanese and issued to these men—nearly 25 per cent. of all Japanese employees on the payroll being students of the bureau, in good standing.

Use of Photographs

An unusually efficient photographer is attached to the staff of the bureau, and, after an instruction paper is written, he familiarizes himself with what must be taught the student, and goes out on the road and takes such pictures as are necessary to properly and helpfully illustrate the lesson.

The lessons, when prepared, are furnished to the students in the regular manner; that is, a pamphlet containing instructions on how to study is sent out, together with the first lesson of the course requested. All lessons contain a list of examination questions. Answers are sent to the bureau, graded, and returned to the student. The bureau is very liberal in allowing the employees to take up practically any course they desire, although it prefers that a course, applying to the line of work that a man is engaged in, be taken. The examination questions on the lessons are asked in such a way as to require a maximum of studying, with a minimum of writing, the desire being to furnish the information, and to have it absorbed, without compelling the student to spend any more time than is necessary in writing out answers. This also reduces the office necessary to handle the correction of the papers.

Men who desire to engage in another line of railroad work than that in which they are employed are, under certain conditions, assisted in making transfer from one department to another, although this transfer must be made with the approval of the heads of both departments interested.

In order to take further advantage of the good which the bureau may do, the operating department has arranged that, in certain cases where men are selected for promotion, they will be given special training at the company's expense, to fit them to enter upon the duties of their new position; this is done before the promotion is announced.

For example: A trainmaster, selected for promotion to the position of assistant superintendent, has been given a year's training at the expense of the company, and has been paid during this training period the salary he was drawing when selected for promotion. This man came from the ranks, served as brakeman and conductor and was in station service before being promoted to trainmaster. He was given three months' experience in the track department, served as laborer and assistant foreman, did the manual work under the direction of a selected foreman, and at the same time, studied special information on track work, supplied from the bureau. He was then put into the position as handy man at the shops and served three months in the motive-power department, with an erecting gang, breaking in engines, in the roundhouse as a handy man, and in the air-brake, lubricator and injector repair departments. He was then given special training in the store department, relating to material and supplies; and is finishing his training in the accounting department, spendng a few weeks in each of the various subdepartments under the direction of several auditors. He may go back into service at the completion of his term of training as a trainmaster; but, we have available, whenever wanted, a man who can step into the position of assistant superintendent, thoroughly familiar with our methods and practices, and ready to travel at full speed from the day he assumes the position.

From two to six men are constantly under special training, being selected from clerical positions, from among station agents, or from the operating engineering, or motive-power departments, according to the recommendation of their superior officers, the men selected having shown by their loyalty, their attention to duty and their work that they are entitled to consideration and promotion. Such men are handled by the operating department, and the expense of their training is borne by the operation department, not by the educational bureau.

Answering Questions

In order to reach a large class of men who might not desire to take up a special course of training systematically but who desire information from day to day concerning points that arise in their work, the educational bureau gives any employees the opportunity to ask any questions they may desire about their work or about railroad work in general. Such questions are either answered through the bureau direct, or, if necessary, referred to the department involved. All answers are reviewed by the advisory board before being sent out to the students, thus insuring the accuracy of the information and preventing any complications from arising, due to questions of discipline or legal matters.

In establishing the bureau, the fact was recognized that an important factor in efficient organization was to get as good a class of men as possible to enter the

service. For that reason, the bureau conducts an employment bureau on a very small scale. It receives applications from anyone anxious to enter Union Pacific service, and all officials are free to call on the bureau for men to fill vacancies, if they so desire. The bureau furnishes the best available material on hand, if there are any suitable applicants registered. In many cases, where vacancies are open that are in the nature of promotion positions, instead of positions at the bottom of the ladder, as in the previous case, a request will be sent to the bureau, asking if there are any students who have shown such proficiency in their work as to make them available for promotion. In this manner, a considerable number of men have been supplied for positions which were of the nature of promotions, who otherwise would have remained unnoticed in the service, while the vacancy would have been filled with an "outsider."

Training for Station Agents

A school has been established at the bureau headquarters, for the purpose of training men to enter station service, with the expectation that they will later qualify as operators or station agents. This station training school does not teach telegraphy, but accepts applicants who have had telegraph training and can receive from 18 to 20 words per minute. The school is equipped similarly to a medium-sized station, and is under the charge of one of our successful station agents. All railroad wires are cut into the school. The standard forms, tickets, baggage checks, etc., are used, and a four-weeks' course of study is outlined. This starts the student on the bill of lading and waybill, and carries him through the tariffs, teaches him rates and classifications, ticket business and baggage business, mail and express business, car reports, and in fact all the simpler work a station agent is called on to do. Several hours each day are allotted to practice on the telegraph wires; and all station helpers for the system are supplied from men who have gone through this school. Previous to the establishment of this school there were furnished in one year for the Union Pacific system, 530 station helpers, of whom 60 per cent. left the service within a few months of the time they were hired. Since the establishment of this school, but 4 per cent. of the helpers furnished have left the service, and numerous promotions of the station-school graduates have been made. Several men, who have never had any experience but their telegraph-school training, have been promoted to positions as telegraph operators within three weeks after leaving the station school.

The bureau is just a little over a year old. A great deal of preliminary work has had to be done in preparing courses and working out methods. No attempt has been made to get students for the bureau. Practically all that has been done has been to announce that such a bureau has been established and is open to employees. Over 1600 employees have voluntarily asked for assistance; of these 80 per cent. have made good; that is, are studying and are in good standing with the bureau. Almost every man taking advantage of this work expressed his appreciation of what the company is offering him, by saying he will try to pay for it by doing better work. It is producing the spirit of loyalty desired, and is increasing the efficiency of those men who are taking courses.

The progress of the work is such at the present time that the general campaign will soon be made to acquaint all the employees of the benefits offered by this bureau, and it is expected that, without doubt, the enrollment can be increased four or five fold with little effort. The expenses have been remarkably low; so low, in fact, as to leave no doubt in the minds of our officials that the investment has been an exceptionally good one. It has put new life into a large number of men, who previously saw no opportunity to get out of the rut they were in, and is building up a class of men from whom will come our future officials.

Making Things—Saving a Belt

By John R. Godfrey

When it pays to make and when to buy.

Cutting out the backing belt or changing it to make a two-speed countershaft.

I am perfectly willing to agree with some of the objectors to my story of the small grinding wheel, that there are times when we can make things for the shop more cheaply than we can buy them, and if we confine ourselves to those things everybody will, or ought to be, happy. The trouble is in knowing where to draw the line.

In the old days—and not so very old either, because I remember the last of them—all shop superintendents thought they must make their own taper pins, bolts and set screws. But that was before they became specialties, and were made as cheaply as they are today. We would not think of making set screws now, unless they were of special size, and that gives the clue to the dividing line that should determine when to make and when to buy.

As a general proposition it is pretty safe to buy everything in the way of supplies that is made regularly for sale. Special sizes of drills, taps, reamers and the like can often be made fully as cheaply as bought, but not always.

When you can really make regular goods cheaper than you can buy them, it is time to start in the business. The great trouble is that we are all too apt to count only the labor and material as the cost, instead of counting in all that goes into the real overhead expenses, to say nothing of delaying the regular work.

Cutting Out the Backing Belt

While it is a recognized fact that not over 5 per cent. of the lathes in a shop ever cut a thread, or to put it differently, less than 5 per cent. could cut all the threads to be cut, how many lathes do we find without the backing belt on countershaft? Mighty few, unless we count the single-belt, geared heads, which have the reverse through a tumbler gear in the head.

A friend of mine has made a radical move in this connection, that looks good to me. He has taken off the backing belt on every lathe except those on which threads are cut.

Where he needs a wider range of speeds for his lathes, he simply puts a larger pulley on the line shaft where the backing pulley was (unless it is already large for a high-speed reverse) and runs a forward belt on both countershaft pulleys. This gives two rates of forward speed for the lathe, depending on the position of the shifter.

Why is not this a pointer for lathe builders in general? A three-step cone with double back gears and the simple two-speed counter gives 18 speed changes and does away with the small steps on the belt cone, where all the trouble comes from. Even a two-step cone with double back gears, gives 12 speed changes.

Where the lathe has plenty of speeds without this, he simply takes off the belt and keeps it to use elsewhere. This saves belt wear, friction on the counter and live shaft, and seems better in every way.

Sheet aluminum makes better vise jaws than either copper or brass. It can be obtained in any thickness from machinists' supply houses.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

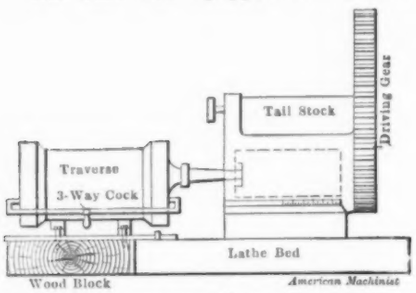
Air Traverse for Heavy Tailstock

About a year ago we installed a new 42-inch car-wheel lathe in the Jackson Street shops, and great things were expected of it.

A record of 22 pairs of wheels in 10 hours was claimed for the machine. But this could not be done on our road as the Great Northern must brake their trains harder in the mountainous district than Eastern roads do. This makes the tire so hard that only the very best steel will cut it.

We had none of this steel, and it was a problem as to the output being increased over our old lathes. I started the machine and managed to turn 7 pairs a day. This was not satisfactory to me and I looked about for a remedy. I first noticed the length of time it took to take the wheels in and out of the machine.

The lathe was equipped with a hand



AIR TRAVERSE FOR HEAVY TAILSTOCK

rigging to move the tailstock back and forth, consisting of a gear, a rack and long levers. This was very slow and took about 10 to 12 minutes to change the wheels from floor to floor. So I got up an air cylinder and applied it in the following manner:

I set the cylinder on a wood block about even with the base of the tailstock, that being the most convenient place. I then piped it from both ends, using a three-way cock for air admission and release; making it double acting. I then removed the hand device furnished for this purpose.

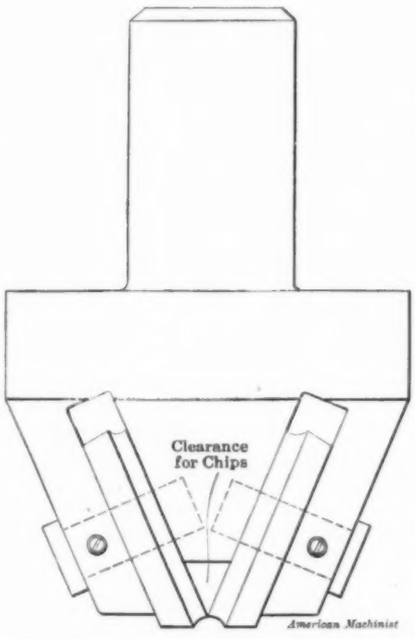
The air traverse is giving satisfaction, both in service and time. No repairs on this have been necessary and we have cut the time of changing down to 2 minutes and increased the output to 12 and 13 pairs in 9 hours.

In addition to this I made a scale 48 inches long, graduating it for a distance of 24 inches for the operator to use when setting his calipers. This I applied on the side of the tailstock in a convenient place.

St. Paul, Minn. THEO. ROWE.
General Foreman.

An Improved Rivet Spinning Tool

The line cut shows an improvement I have made in a spinning tool used for forming rivet heads by spinning. In action the rolls are caused to rotate in opposite directions and any scale, dust or



AN IMPROVED RIVET-SPINNING TOOL

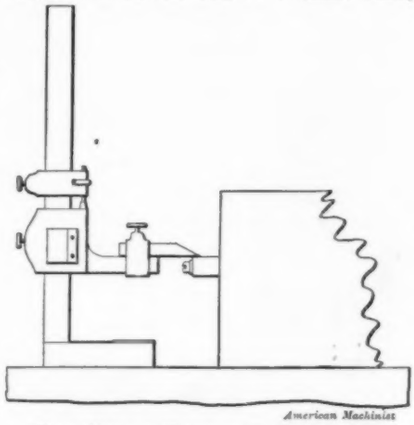
fine chips which may be removed during the operation cannot possibly clog the rolls as is the case where two half rolls are mounted on one shaft whose axis is perpendicular to a line drawn through the center of the rivet. The rolls shown have been used for some time with entire satisfaction.

Hartford, Conn. MODERN.

The Hight Gage and Accuracy

To measure accurately with the hight gage is something quite difficult, a great deal more so than close measuring with a micrometer or vernier caliper.

Most mechanics believe that no two men have just the same "feel" on the micrometer, although the ratchet stop has decreased the difference in "feel" to a minimum. The hight gage being heavier and with its base always firmly held on the surface plate does not allow of the sensitive "feel" of the micrometer. But we of the trade get around this deficiency very nicely. Let us say, for example, that we have a button to locate, as in the cut. After the button is mounted, take a little piece of waste or absorbent cotton, roll it on the end of a small stick,



THE HIGHT GAGE AND ACCURACY

then with a little Prussian blue on the cotton, smear the part of the button which the hight gage will touch, then with the hight gage "set" move it over the button as you ordinarily would. If there is any "feel," ease your button a little by tapping. The line of contact between the gage and the button will be distinguishable on the button by a narrow bright line, which is caused by the hight gage removing the thin coat of blue from the button. When you no longer can feel the button under the gage, then you look for the line of contact, which will appear distinctly, although all sense of touch has gone. In this way you can set your hight gage.

In measuring flat surfaces the method is a little different, for you are not likely to see the line of contact, but lift your gage and look at the under side of the jaw which you have just passed over the surface smeared with blue. When it has a slight deposit of blue on it and still you are not able to *feel* any contact, you are reasonably sure to have your gage set correctly to read.

Newark, N. J. JOHN MELVILLE.

Air Hammer for Railway Shops

The accompanying sketches show a homemade air hammer which I designed in 1902, which is still in everyday use, and considered a valuable tool in blacksmith shop.

It employs air at 125 pounds pressure, making this hammer very quick and powerful. It is capable of welding 3-inch round iron, and is well liked by the men because of its cleanliness and absence of heat, as from steam hammers.

The Chicago & North Western Railway has several of these hammers located in terminal roundhouses, where they are of great help on running repairs. It should be of interest to all general foremen of railways.

CHARLES MARKEL,
Shop foreman, C. & N. W. Ry.
Clinton, Iowa.

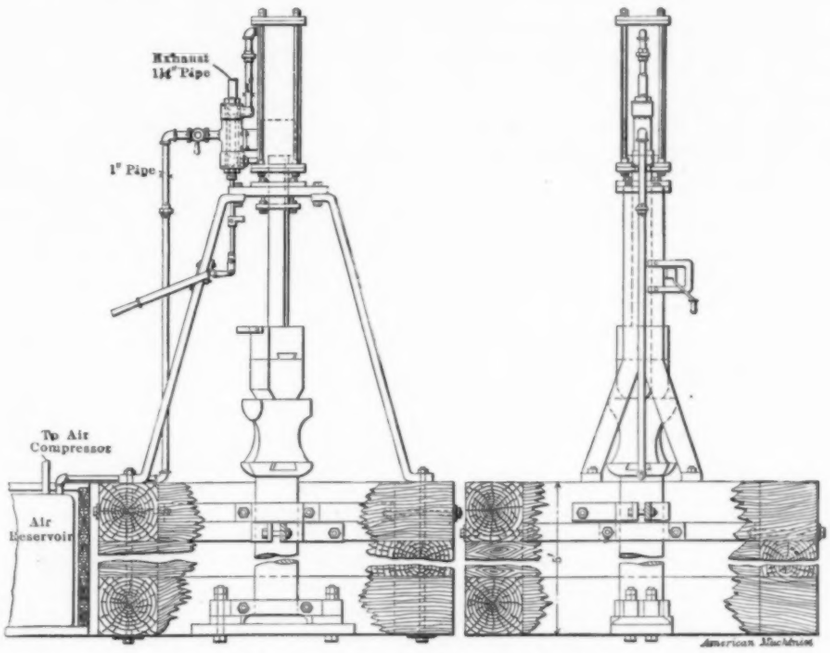


FIG. 1. RAILWAY-SHOP AIR HAMMER

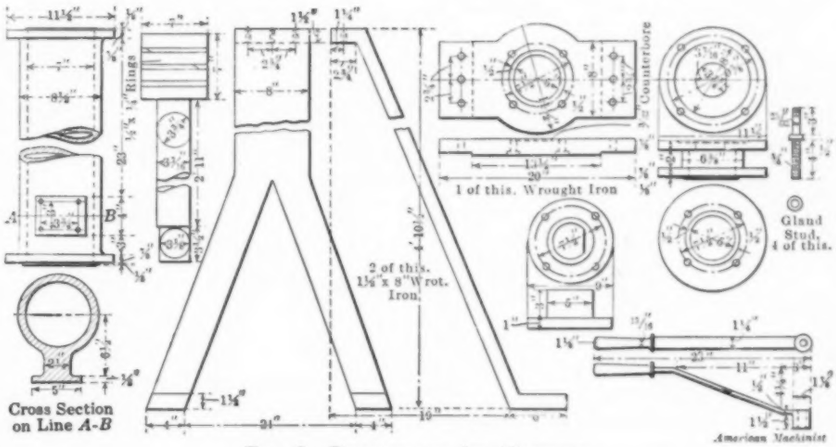


FIG. 2. DETAILS OF AIR HAMMER

Keeping Up with the Profession

The continuous numerical increase on the membership of the American Society of Mechanical Engineers cannot be otherwise than gratifying both to those directly interested in the prosperity of the society and to the engineering profession as a whole. The later growth of the society, however, to many of its most devoted members has been more or less disappointing in at least one particular. It may as well be confessed that the attendance at the New York meetings of the society, especially the monthly meetings, and the resulting transactions of the meetings, these being ostensibly the purpose of its existence, have not kept pace with the numerical growth. None will for a moment think that this results at all from any lowering of the personnel, it being the fact that the standards of admission to the society and the scrutiny of candidates have been constantly tending upward.

The society is now fully 30 years old, and the discouraging developments which are talked about have been most pronounced in the last decade. Comparing the meetings of the earlier years with those of the present, those whose memories reach back far enough are regretfully conscious of the difference. Many of the most active participants in and most prolific contributors to the earlier meetings, of course, have passed or are passing away, but notwithstanding the increasing membership they do not seem to be replaced in numbers or in kind. The engineers of today are as able and more numerous than ever, but this might not be inferred from the records of the society's meetings in recent years.

It really would seem to be not difficult to explain the lack of interest in the regular or special meetings of the society and the consequent paucity of papers and discussion. It is a kind of self propagating or self-perpetuating derangement. It cannot be expected that members will laboriously prepare precise and elaborate papers without the probability of an appreciative and sufficiently numerous audience to make it worth while.

Not only the numbers but the makeup of the gatherings carry their suggestion. The older and more experienced, or, as we might say " solider" members are conspicuous by their absence. Probably the average age of the membership in attendance at the more recent meetings is 10 years less than it was in the eighties. It is fair to assume that the older members do not attend because they have no sufficient interest in the matters more

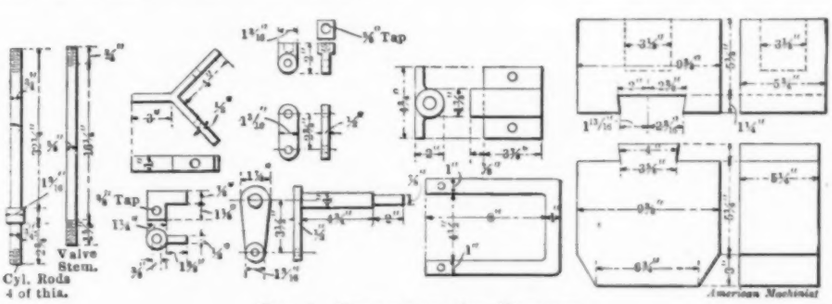


FIG. 3. DETAILS OF AIR HAMMER

recently presented for consideration and discussion.

The tolerably evident fact is that these most valuable elements of the society's working force are allowing themselves to be left behind. The society, as it should, has progressed, has kept up with the times in the selection of topics for discussion, while the older members have preferred to cling to the old things.

The *piece de resistance* for every meeting reported in the earlier volumes of the society's transactions was something about some type of steam engine, and next to that would come, perhaps, some detail of ship manipulation, and the variety beyond those would be small. Matters which had then never been thought of have now come to the front too numerous and various to speak of. The entire electric industry has developed, as vast and diverse as the steam category, also the numerous applications of compressed air, oil and gas engines, centrifugal pumps and turbines, the bicycle has had its run and now the automobile and the aëroplane are to the fore.

The mistake common to some of the older members of the profession is in the too ready assumption that there is not as great engineering skill displayed, nor as much to tell of and discuss in these latter details of occupation and achievement as in the earlier ones. One of the biggest disappointments to an old-time engineer must be a visit to the engine room of a turbine-driven ocean steamer. There is so little there to see and nothing to admire, no working machinery visible, no shining brass and steel, no intricate and curiously working valve motions, no apparent minute adjustments to be watched; yet here is embodied the concentrated and sifted wisdom of engineering up the moment, the culmination of all preceding study and experiment, the intimate knowledge of which is the most promising of future progress.

The other and later developed lines of engineering are without glitter and offer little to attract those unfamiliar with them. Nothing perhaps would be less likely to invite the investigations of an old-time engineer than the modern cement plant as seen from the outside, and when such a plant was the topic of the evening at the latest monthly meeting of the mechanical engineers, it is really not much to be wondered at that the white or gray heads were so scarce.

Those by their absence missed their opportunity of extending their outlook along one of the many lines of modern mechanical engineering. How many papers have been read and how much discussion has resulted to fill the transactions of the society concerning pumps and pumping engines. Yet the operation of cement manufacture along a commercial scale offers a problem vastly more complex. It engaged the inventive faculties of Thomas A. Edison for years and seemed to have challenged his best efforts.

In typical cement plants there are units which produce 2000 barrels per day. The materials, specially selected of broken rock, with clay or shale, the chemical compositions of each being known with exactness, are combined in precise predetermined proportions, then are ground and sifted to the fineness of wheat flour and this powder is fed through the kiln to be burned, emerging from this in the form of clinker, again to be ground and sifted and packed in barrels for shipment. There is no hand work, everything being done by mechanical means and the cycle of operations being automatic and continuous.

The rotary kilns are cylindrical and of various dimensions up to 250 feet long (the length of a New York City block, up and down the avenues is 200 feet) and 12 feet in diameter, the largest, up to the limit yet reached showing the best economy. A kiln is set at a slight angle from the horizontal, say ¼ inch to the foot, with proper means of support and is continuously rotated. It is lined with the most refractory materials, as temperatures up to the highest, which are common in steel manufacture, say, 2700 degrees Fahrenheit, are necessary to produce the required chemical reactions involved in the "burning." The material to be burned is fed into the upper end of the kiln, the inclination combined with the rotation carrying it slowly along. A mixture of air with gas, oil or pulverized coal is blown into the discharge end of the kiln by means of compressed air, furnished by an air compressor or blower. When ignited this mixture of air and combustible forms a flame or blast of variable length which comes in contact with the feed and drives off the moisture and then the gases, after which clinkering takes place at the highest temperature reached. What goes on in the kiln is quite definitely known, the exact temperatures at different points throughout the length, for instance, being obtained when desired.

Now, to carry all this through successfully is engineering which is not to be despised, and to know something of the true inwardness of it when the opportunity is given should be the aim of the progressive engineer. To keep up with the profession it is necessary to follow up the things which are not along our regular lines of occupation. The mistake from which the society suffers is in the habit of the members of attending the meetings which have to do with the things about which they know the most and of avoiding those upon topics about which they know little or nothing, when precisely the reverse should be the habit.

TECUMSEH SWIFT.

New York.

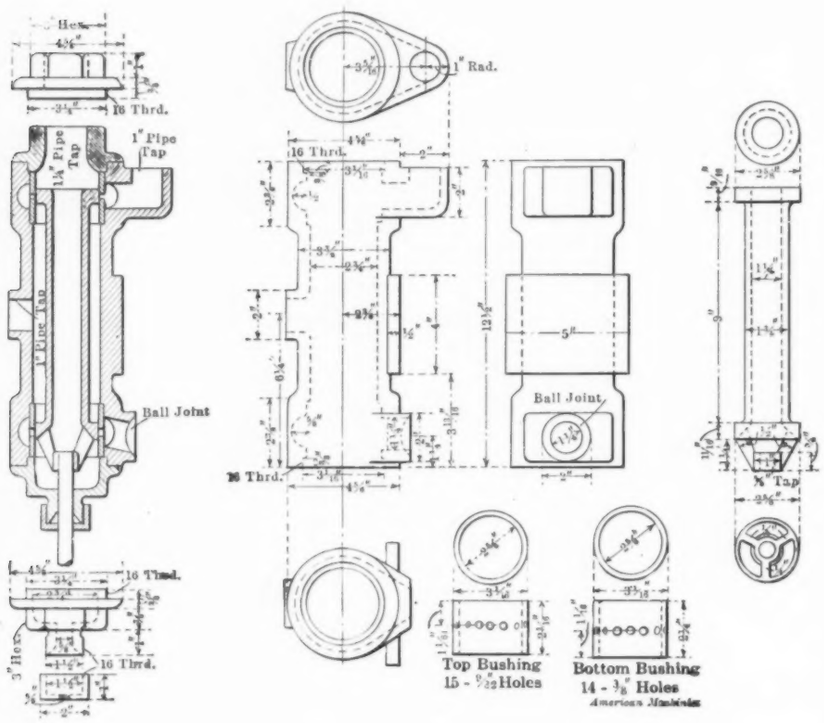


FIG. 4. DETAILS OF AIR-HAMMER VALVE

Some Millwright Troubles

A short time ago I had charge of some alterations to be carried out on the plant in a local mill, and as it caused a lot of hard work on the part of the man on the job, and also upset the estimated cost of the contract, which was a more serious matter, it might be interesting to describe some of the unlooked-for troubles to your readers.

The first job to take in hand was the removal of a flywheel of an inclosed high-speed engine, which was to be sent on to the shop that evening without fail, to have a coupling face turned on it. This to allow of a short shaft being coupled up, the shaft going through a wall about 12 inches from the flywheel. No difficulty was anticipated in removing this wheel. A chisel behind the key head was expected to do the trick. A light blow was struck and the head bid good-bye to the body. This did not cause much worry. The man in charge was of the "never say die" sort, and at once got a move on, and had cylinder and casing lifted and crank shaft removed. I think the cursing really started when he saw the position of that key, which was as shown at Fig. 1. The space between the flywheel boss and web of the crank was about nine inches. He could not apply a drift. The wheel also refused to be driven along the shaft, so he sent the job to the shop, some thirty odd Irish miles, and then spent the rest of the evening giving out choice remarks about the man who could be such an idiot as to put a keyway on a crank shaft at the one place you cannot give the key a "blow on the nose," and about the draftsman who did not allow the shaft to extend beyond the wheel to give the key a chance.

At Fig. 2 is a sketch of pulley, which was about 36 inches diameter by 30 inches wide. It was on the second-motion shaft of a large engine and had to be moved a few inches along the shaft. This pulley was also fixed close to a wall, and the job was expected to occupy a man and a ladder for an hour or so. As the key head looked flimsy, every precaution was used in attempting the removal of this key, without avail. The head came away, and after trying everything that could be thought of, except knocking a hole in the wall, to get at the point, the shaft was taken down "to save time." After removing the broken key we fitted a new one with a much stronger head, in which we put a ¾-inch tapped hole (the key being 1¾ inches wide), so that the key can now be drawn with a set screw. No doubt the next man who handles that job will express his thanks for the thoughtfulness of the firm who erected the plant, without a single thought for the poor millwright.

We also had to remove two half couplings to make alterations to the pulleys. One came off without any trouble; the other refused to give way with the same treatment. The first one had a key with the large end to the shoulder on the shaft, the other being as shown at Fig. 3. The key was removed after we had drilled and tapped a hole in the end; but why one coupling was keyed on correctly and not the other is still a puzzle. As we were under contract and penalty, I thought it advisable to explain these unforeseen difficulties to the management of the mill, making a great point of the improvements we had given, which were not in the contract, especially the turning of the flywheel in place on the shaft, with a view to an extra on the contract. But it was useless. The manager I found was badly bitten with the bunco bug, and all I obtained was a lecture on the excellence of the plant in general, that it was all about new, especially the high-speed engine, and the firm who made and erected it had quite a reputation for up-todate ideas. But my millwright gang thinks some of them really belong to the Dark Ages.

Belfast, Ireland. F. P. Strachan.

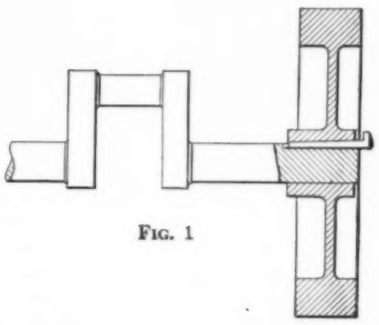


FIG. 1

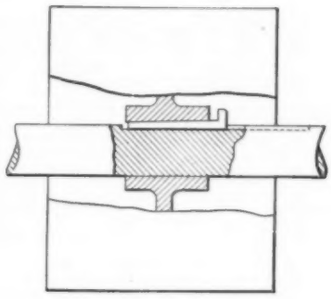


FIG. 2

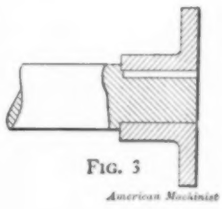


FIG. 3

American Machinist

SOME MILLWRIGHT TROUBLES

Buckeye Engine Trouble

Our 11x14-inch single-cylinder, non-condensing Buckeye engine had shut down at a time when there was only a small load on the generator to which it was belted, and could not be started. Upon examination it was found that the governor wheel had slipped; rotated forward on the shaft, which, of course, caused the riding-cut-off valve to prevent the admission of steam.

After setting the valve and thoroughly clamping the governor wheel, the engine ran under load but there was a thudding noise which could not be located. Examinations were made of all bearings and parts without finding the seat of trouble. The thudding was growing worse all the time till the engine shut down again, first gradually slowing up. The governor wheel had slipped forward and affected the valve action just as before.

By looking through the split hub of the wheel, the thin film of oil on the shaft showed lines indicating clearly that the wheel had slipped, a very little at a time; probably two degrees each revolution. Then, reasoning that any interference or binding action would cause this wheel to have slipped backward relative to the direction of motion of the shaft, it was supposed that the cause must be found in the inertia of some loose part.

By feeling with a thin blade along the key in the flywheel hub it appeared that the key was slightly smaller than the key-way. Although the key and hub were each set-screwed, it was plain that a very small part of an inch play between the key and the hub would permit of perhaps ¼ inch motion at the rim of the flywheel. A set screw was then put through the hub of the wheel in a direction tangential to the shaft, the action of which would draw the key up tight against the hub. This cured the thudding noise and no further stopping of the engine for unknown causes was experienced.

The explanation is that when the piston came up against the forces of compression, the reciprocating parts were held back and the flywheel, due to its inertia, slipped a little forward on the shaft. As soon as past dead-center the new steam forces threw the members forward against the flywheel and belt load. The result was the same as if the governor wheel had been struck with a sledge each revolution.

Cincinnati, O. R. G. B.

Punching Lugs on Small Tubes

Some time ago we had an order for some thousands of tubes, as shown at *Z*. The only part which presented any difficulty was the shearing and forming of the lugs, which are cut from the body of the tube itself. This difficulty was intensified by the size of the tubes, which were of small bore, 9/32 inch, and relative thickness of stock, 3/32 inch, making the outside diameter of the tube 15/32 inch, and as the width of the lugs, ¼ inch, was close to the size of bore there was very little room for tools to work from the inside.

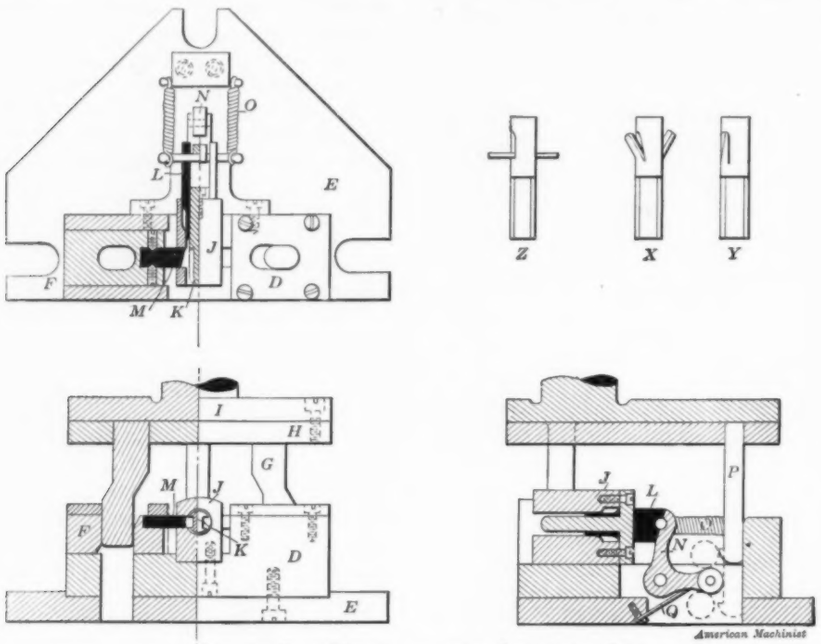


FIG. 1. THE WORK AND THE SHEARING DIES

After a little experimental work the tools shown in the cuts were made and performed the work of shearing and forming the lugs quite satisfactorily.

The tubes are of solid drawn brass and are located in the press tools by the sectioned part of the tube.

Fig. 1 shows the shearing tool which, in shearing the stock of tube, presses the lugs slightly inward; see *Y*.

The tool consists of a bottom tool made up of a machine-steel base block *D* fastened by three fillister-headed screws to the cast-iron bolster plate *E*. The block *D* carries two case-hardened machine-steel punch holders *F*, which are actuated by hardened and tempered steel cam rods *G*. These are a driving fit and riveted over in a machine-steel plate *H* secured by six screws to the cast-iron punch holder *I*.

J is a steel receiver, fastened to *D* by three fillister-head screws. This receiver carries the hardened and tempered tool-steel die *K*, fastened by two fillister-head screws.

L is the hardened and tempered tool-steel shedder, which is held a sliding fit between the punch *K* and the receiver *J*. This shedder also acts as a stop for the tubes to abut against. When a tube is in position in the tool the parts are all supported by each other. The die *K* is a sliding fit inside the tube and the tube is a sliding fit in the bore of the shedder *J*. Slots cut in the shedder *J* form guides and supports for the shearing punches *M* of tool steel, hardened and tempered. The receiver also prevents the shearing punches distorting the body of the tube, holding the tube well up to the punches, making their work easier. The machine-steel bell crank or lever *N* for actuating the ejector or shedder *L*, is actuated by the catch ram *P*, which is made of tool steel, hardened and tempered at the business end. On the down stroke of the press *P* passes the end of the bell crank *N* after pressing it down, the bell crank *N* being returned to normal position, shown in the cut, by the flat spring *Q*, which is secured to the bolster plate *E* by two fillister-head screws. On the upward stroke of press the catch end of *P* engages with *N*, which forces the shedder *L* forward, ejecting the work off the punch *K*. The shedder is pulled back into position of stop by the springs *O*.

The cam rods *G* are designed to give both forward and return motions to the punch holders *F*. After being sheared the tubes are as shown at *Y*. It was found that by forcing a flat-bottomed punch through the tubes, it sprung the lugs out as shown at *X*. This took place owing, no doubt, to the strain on the stock in shearing.

This is embodied in the second operation. The tool shown in Fig. 2, two views in half section, consists of a tool-steel ball *A* secured by two fillister-head screws to the machine-steel base plate *B*. C is a tool-steel taper pin, which, when in position, presses the flat-sectioned side of the tube against the machined face in the base block or receiver *A*. *D* is a tool-steel punch, which enters the tubes and forces the lugs out. This is held in the tool-steel punch *E*, which presses the lugs into the recesses in the base block *A*. This punch is recessed to hold *D* and also to allow the passage of the heads of tubes and is secured in *F* by a tool-steel set screw. *F* is a machine-steel punch holder recessed to hold *E*, and also carries the rods *K*, which actuate the tool-steel ejectors *H*, which are tempered and have springs *J* to return them.

I is a machine-steel bar for actuating

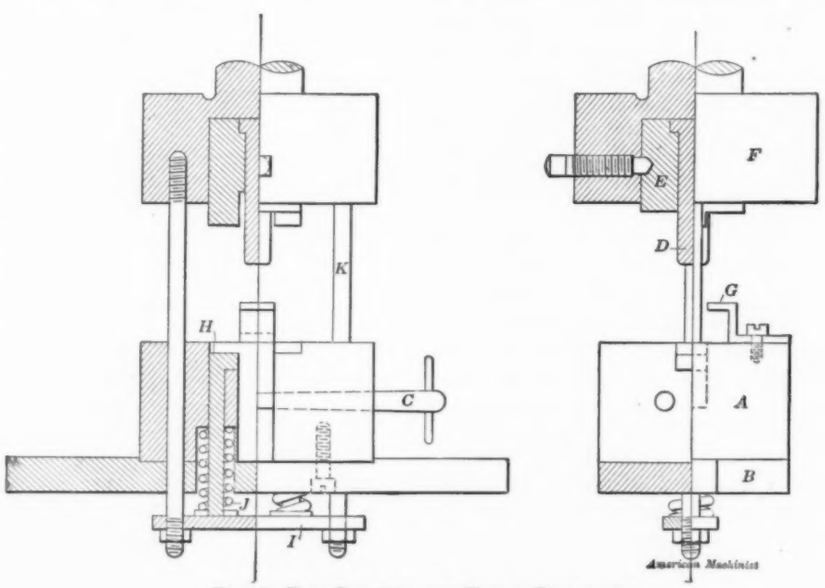


FIG. 2. THE DIE FOR THE FINAL OPERATION

the ejectors *H;* it is secured to the rods *K* by nuts.

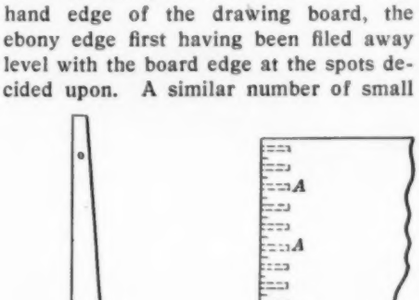
G is a tool steel stripper to prevent the tube sticking to the punch. In action the small punch *D* enters and forces the lugs out, the bending punch *E* engages and bends them over into a recess in the die *A*, and flattens them, also bringing their center line parallel to the sectional half of the tube.

London, Eng. H. HARRIS.

Magnetic Tee Square

Every draftsman knows the difficulty of holding the tee-square nicely up to the edge of the board when working, and most of them appreciate any contrivance to aid their work. Many such have been described from time to time. Here is another.

A number of holes, the number and size of which will vary with the size of the board in hand, are drilled into the left-hand edge of the drawing board, the ebony edge first having been filed away level with the board edge at the spots decided upon. A similar number of small



MAGNETIC TEE SQUARE

bar magnets are then made by cutting off pieces of round cast steel of suitable diameter and length to fit the holes previously made in the board. These are then ground square on one end, hardened dead hard if possible, and then magnetized.

The magnets so made are fitted into the board, ground end outward, and dead flush with the working edge. This is accomplished easily by smearing them with glue and pressing home with a straight edge of any description.

The stock of tee-square is soon dealt with; the working edge of this is faced with a soft-steel strip, made perfectly straight, and carefully screwed on to avoid any distortion. There must be a sufficient number of magnets, and close enough together to insure that several shall be acting upon the steel strip of the tee-square in all positions, to give it security.

This will be found a satisfactory method, and the tee-square, though easy to move, will remain where placed and always snug to the side of the board unless undue pressure is applied when using.

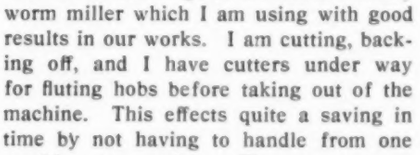
In the appended sketch *A A* are the magnets, and *B* the steel strip, screwed to tee-stock.

Coventry, England. J. A. N.

Silencing Gear Wheels

The cut shows a method of lagging gear wheels with wood; this has the effect of silencing the ring when steel wheels are used and are run at a high speed. The wheel shown is of the disk type, several holes are cored in the disk and then plugged up with wood, then two other wood disks are inserted, one at each side.

Coach screws are used for keeping the lagging in place, the disks should all be a tight fit and must be made of well seasoned and fairly hard wood. A more perfect job is made if the spaces between the wood and the wheel are filled up with red lead; for this job some people also use sheet india rubber. I have used this kink for years; although it is old it is surprising how many people there are



SILENCING GEAR WHEELS

who have never heard of it. One exceptionally useful application is on crane work where quiet running is very essential.

London, England. A. M. B.

Backing Off Attachment for the Worm Miller

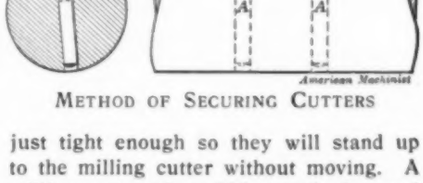
The halftone shows a backing-off attachment made to go on a Pratt & Whitney worm miller which I am using with good results in our works. I am cutting, backing off, and I have cutters under way for fluting hobs before taking out of the machine. This effects quite a saving in time by not having to handle from one machine to another. The same cutter does for backing off and cutting the thread, which also means a big saving of making special tools for backing-off attachments used on lathes. This attachment can also be used for milling small cams. At *D* I use the same cams that we were using on our lathe backing-off attachment. *A* is a bracket fastened to the bed by two bolts. It carries one end of the cam shaft *C*, also the cam-shaft gear. *B* are two gears of equal size; the driver I fitted on the hub of the driving plate, the driven is keyed on the cam shaft *C*. By placing a cam with the number of teeth desired between the bracket *E* you will get the same number of flutes in the hob.

F is the cam yoke which is fitted in the T-slot on the slide and is made so it can be adjusted to accommodate different diameters of hobs. *G* is a nurled adjusting screw, screwed in the cam yoke and drilled through the center to take a hardened-steel pin. This pin is kept in close contact with the cam by a weight suspended at the rear of the machine and fastened to the saddle.

Dundas, Ont. H. A.

Method of Securing Cutters

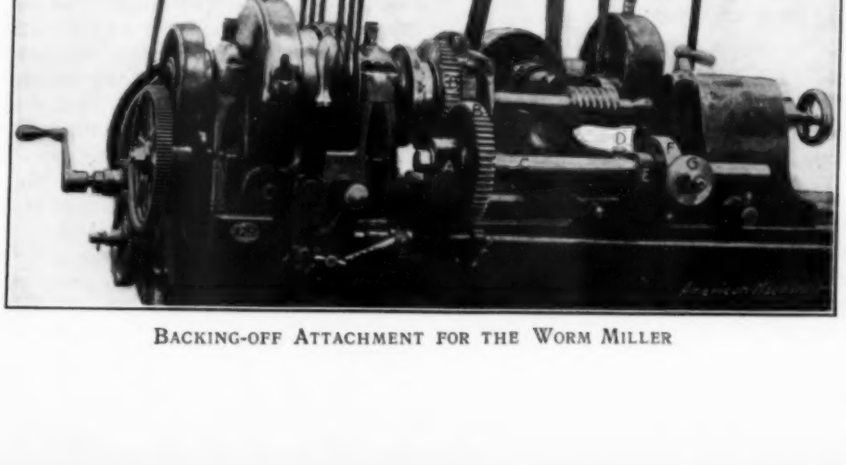
This method of fixing a cutter in a boring bar, which I used lately and found quick and effective, may prove useful. The holes for the pins are first drilled so that the pins *A*, of drill rod, will drive



METHOD OF SECURING CUTTERS

just tight enough so they will stand up to the milling cutter without moving. A milling cutter of a width to suit the steel to be used for the cutter *B* is sunk into the bar and traversed, through pins and all, the length desired. The cutter is then fitted. When in position, a light blow on the pins will hold the cutter against any reasonable cut. A blow with a punch on the other end of the pins will loosen the cutter and start it out of the slot.

Richmond, Va. T. W. KINGS.



BACKING-OFF ATTACHMENT FOR THE WORM MILLER

To Bend Small Tubing

For bending small brass or copper tubing take a closed spiral spring that will just slip into the tube which should first be annealed on the part to be bent.

Use a form of wood to give the proper shape. To remove the spring after bending the tube, twist the end of the spring in the direction that it is wound which will make it slightly smaller and allow it to be taken out easily.

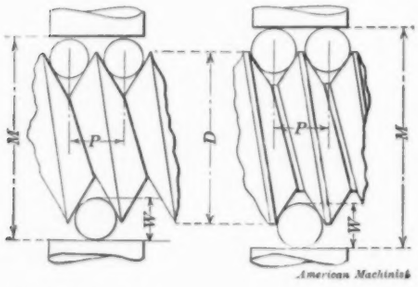
This method works out nicely on tubing up to ½ inch diameter, but the spring should be fairly heavy gage wire.

Torrington, Conn. E. L. F.

Measuring Metric Screw Threads

To those engaged in work requiring the frequent production of thread gages or special taps in the metric sizes, the table and formulas given herewith may be of value.

This method, as will be seen, is based on the well known use of 3 wires, laid in



For V threads

$D = M - 3W + 1.732P$;
$M = D - 1.732P + 3W$.

For threads with flat top and bottom equal to ⅛ of the pitch

$D = M - 3W + 1.5155P$;
$M = D - 1.5155P + 3W$.

Pitch m-m	Pitch Inches.	1.732P	1.5155P
0.5	.01969	.03410	.02984
0.75	.02953	.05109	.04475
1.0	.03937	.06819	.05966
1.25	.04921	.08523	.07458
1.5	.05900	.09719	.08941
1.75	.06890	.11933	.10442
2.0	.07874	.13638	.11933
2.5	.09843	.16948	.14917
3.0	.11811	.20456	.17899
3.5	.13780	.23867	.20784
4.0	.15748	.26775	.23866
4.5	.17717	.30686	.26850
5.0	.19685	.34094	.29833
5.5	.21654	.37500	.32816
6.0	.23622	.40913	.35799
6.5	.25591	.43773	.38783
7.0	.27559	.47677	.41766
7.5	.29528	.51092	.44749
8.0	.31496	.54551	.47732
9.0	.35433	.60870	.53699
10.00	.39370	.68189	.59665

CONSTANTS FOR USE IN MEASURING METRIC SCREW THREADS BY THE 3-WIRE SYSTEM.

thread groove on opposite sides and measurements made over them, using ordinary micrometers.

By the use of this method it becomes an easy matter to originate gages or to duplicate existing sizes or samples, with assurance that the angle diameter will be correct, always assuming that care is taken to see that the tools are properly ground to produce the required 60-degree thread angle.

F. CHARLES SCRIBNER.

Greenfield, Mass.

A Grinding Kink

In our shop recently a large plain grinding machine was installed for the external grinding of torpedo air flasks. These flasks range in length from 1 to 10 feet and are from 18 to 21 inches in diameter. They must be perfectly round and exact in size, as well as straight and smooth.

On the first flask put in, the stone took quite a cut on one side, while hardly doing any work on the opposite side, which might naturally be expected. After considerable grinding the flask was found round, and quitting time came.

In the morning, when grinding was resumed, the flask ran out very much as it did on the preceding morning. The grinding operations were duplicated with greater care, but the following morning the same result was apparent. This caused considerable thought and brought forth many suggestions.

Although the stone had a good stream running over it at all times, it failed to keep the temperature of the flask uniform, and when it cooled over night a warping set in as was evidenced in the morning. By filling the flask partially full of water during the grinding operations we overcame this and after again cooling over night the flask was found to be perfectly round and straight as it was left at night.

Newport, R. I. G. S. SLINGERLAND.

Closing Dies Which Were Bored Too Large

We had twelve dies that had to cut a blank 3.53 inches in diameter, but through a mistake they were bored 0.005 inch large. The dies were made by welding a tool-steel ring to a wrought-iron base, the steel being 4¾ inches outside diameter by ⅝ inch deep, the wrought iron being 5½ inches diameter by ⅞ inch deep. We heated them to the heat we usually hardened them at and dipped the iron part only in the water, and the contraction of the iron was sufficient in 11 of the dies to compress the tool steel and reduce the inside diameter from 0.007 to 0.010 inch. The other die had bell mouthed to such an extent as to render it useless. We hardened the dies and found there was from 0.001 to 0.005 inch for grinding, so the cost of these 11 dies was saved. I am going to see what I can do by these means on those dies that have become large through wear.

Hamilton, Ont. W. A.

A Gage Grinding Fixture

Fig. 1 shows a grinding fixture, designed principally for grinding the bent gages B, but arranged for pin gages also; it is of simple construction.

The main part of the tool consists of a mandrel *A A* widened out in the center, to which a plate *B*, with a clamping device *D*, is pivoted at *C* and gibbed at *D*. This plate has a rocking movement of ½ inch, operated by an eccentric at the gibbed end of the fixture. The eccentric is operated by the differential gearing *E* on the tailstock end. As the work revolves the gearing transmits a retarding movement to the eccentric, through a shaft passing through the mandrel. This

FIG. 1. THE FIXTURE

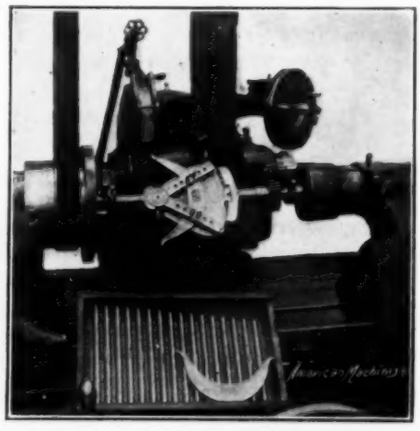


FIG. 2. THE FIXTURE IN PLACE IN THE GRINDER

gives the necessary rocking movement to the work necessary to grind a spherical end. Two split bushings threaded into the pivot bolt *C* and trued with its center take care of the pin gages.

Fig. 2 shows the fixture in place in the grinder. With this fixture gages can be ground practically, rapidly and accurately, with no more trouble than plain grinding.

H. H. ESBENSHADE.

Waynesboro, Penn.

A correspondent sends a definition from an alleged mechanical dictionary which describes a cold chisel as "a sharp instrument with a blunt point."

Discussion of Previous Question

Which End of a Piece Should Be Made First?

If Mr. Bacon (page 690) had used a spring collet, as shown in Fig. 1, which is provided with a combined stop and core to prevent the hole from closing, his original method would have proved successful and been much cheaper than the method finally adopted.

I have used a great many chucks equipped with stops similar to the one shown in Fig. 1. The hole *a* in the back end of the collet should be ground concentric with the outside in order that the core end of the stop will run true when assembled. The stop should have a vent hole drilled, to let the air or oil escape freely from the holes in the parts to be threaded. In order to insure the parts being uniformly located, with this style of a stop, it is not necessary for them to be pressed into the chuck hard enough to expand the outside diameter. If such should be the case they would cause more or less annoyance to the operator by sticking in the sleeve.

The end of the stop which acts as a core, should be a nice, free fit, the clearance not to exceed the elastic limit of the parts being threaded.

This style of stop will make the parts more uniform and will be found far more convenient than one used in the turret. Where it requires the use of but one tool it is not necessary to revolve the turret, which makes it possible to handle the parts much faster.

If Fig. 3, in Mr. Bacon's sketch, had been shown full size, or even several times larger it would have been clearer. It can be made more satisfactorily as shown in Fig. 2 herewith.

In putting the stock into the machine, the combined form and cutting-off tool should be fed by hand until the forming part of the tool commences to do its work on the first piece of each bar, then the operations will be as follows, viz.: Feed stock, using a combined stop and support; form, revolve turret, thread, cut off and form end of second piece.

The large diameter on the forming tool is made from 0.004 to 0.008 inch greater than the next smaller diameter. This is done, principally to eliminate the bur on the diameter *E*. This also acts as a marker for setting the combined form and cutting-off tool. Those who have never used this style of forming tool will be surprised to learn how short the marker can be and entirely eliminate the bur, if the cutting-off tool is adjusted to just clear the shoulder which the marker makes.

The combined stop and support shown

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

are very easily and inexpensively made; the stop *C* and support *B* should both be made of tool steel and hardened.

The part of the hole supporting the work should be lapped or ground smooth, and the outside ground concentric with

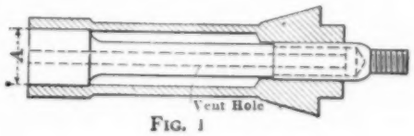


FIG. 1

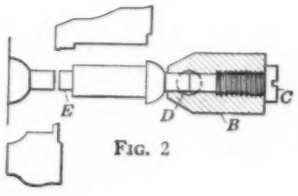


FIG. 2

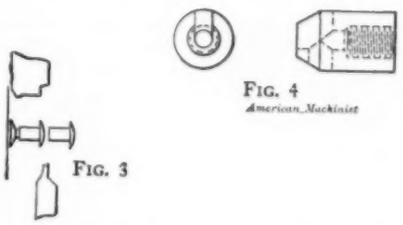


FIG. 4

FIG. 3

COLLET, STOPS, FORMING AND CUTTING-OFF TOOLS

the hole; the hole *D* is drilled to insure the end of the stop being kept clean.

These stops have proved very successful in supporting the ends of long and heavy pieces when they are being cut off. When used for this purpose there should be a slot cut into the supporting hole as shown in Fig. 4. When this is done the stop can be held in position until after the piece has dropped; there will be no teat left on the piece and there will be no danger of the piece sticking in the stop.

The parts shown in Figs. 5, 6, 7 in Mr. Bacon's article can be made a great deal faster, if made as shown in Fig. 3 herewith, as the cutting-off tool performs its work while the body of the rivet is being formed.

It can be fed in with a much finer feed and the tool not require resharpening nearly as often. When the cutting-off tool is used, as shown in Mr. Bacon's sketches Figs. 6 and 7, it is the common practice to feed them from two or three times faster than the forming tool. The point of the cutting-off tool being very delicate should be fed with a much finer feed than the forming tool, and this can be accomplished by the method shown at Fig. 3. The side of the forming tool next to the chuck should either be beveled or made to fit the head of the rivet so the cutting-off tool will begin to cut at the point.

In one factory, with which I have been connected, they were using twelve polishing lathes for removing such burs. In less than two years, after adopting this method, even though the screw machine products had increased 75 per cent., there was not work enough to keep two polishing machines running. I do not agree with Mr. Bacon's adopted rule of "forming parts with a tool whose width is more than twice the minimum diameter to be formed," as he does not take into consideration the materials from which the parts are made, periphery speed, or feed of the tool per revolution.

There is such a vast difference between brass, gun-screw stock and tool steel that each requires its respective formula. I have formed parts from drill rod that were finished 1/16 inch in diameter and 7/32 inch long, and gun-screw stock 3/16 inch diameter and 1 1/16 inches long, and the parts were held to limits of 0.0005 inch plus or minus, which is close enough for almost any class of work.

When surfaces of such great proportions are formed they require the constant watching of the attendant, and for this reason I do not advocate carrying forming to such an extreme.

Detroit, Mich. R. P. SMITH.

Another Reason for Failures

In a recent issue of the AMERICAN MACHINIST the editorial "Why is the Diesel Oil Engine a Failure in America," has stirred up some deep thoughts, and I would like to offer an explanation which I believe to be correct.

I have for many years been an enthusiast for internal-combustion motors. I have inspected a number of magnificent Diesel plants in Europe, and have had a good deal to do with producer-gas engines and I believe the commercial fail-

ure of the Diesel in America is due to practically the same cause as the frequent failure of the producer-gas engine; the practical impossibility of securing efficient operators.

I do not believe, as the editorial seems to conclude, that the commercial failure of the oil engine over here is due to defects in its manufacture. It has frequently been observed that, whereas oil and gas engines have for many years been very successful in Germany in charge of operators of average intelligence who receive very low wages, the same types of engines have met with but indifferent success over here. It has been assumed by many that this difference has been due to superior mechanical ability of the German operators, or to the greater attention paid over there to technical training.

I have been operating my own factory for the past eight years with several large producer-gas engines, and from my own experience and observation of other plants, am convinced that the chief trouble is that the American operator will not take the trouble to properly care for the gas or oil engine simply because he does not have to. If the least little thing worries him, he throws up his job, feeling confident of promptly securing employment in some nearby steam plant which does not require much thinking or very close attention to details.

The greatest difficulty with the average American operator is in starting in the morning. The producer man may have arrived late so that the gas will be poor and call for different air adjustment. The spark plug may be dirty, or the insulation damp, or in the case of German-type engines, the automatic mixing valve may have become slightly fouled. If the engine does not take hold after the first charge of compressed air, the average American operator will not stop and think for a moment, or look for some derangement or cause of trouble—not he—he simply hangs on to the compressed-air throttle until his tanks are empty and then swears by heaven that he has done all that human brains and muscle can do. Then if he is reprimanded, perhaps for the twentieth time, for ignoring some small detail that should have been attended to the night before, off come his overalls. Then comes the long, weary job of breaking in a new man, who, before he has become half trained, feels he can do more, and likewise, departs.

The European operator is not naturally as quick or keen of perception as the American, and his success with the gas or oil engine is not due to any particular virtue. He simply sticks fast and does a little thinking instead of throwing up his job, because he knows that other jobs are scarce and that he can't secure another position without satisfactory references. The whole thing hinges on the question of natural resources. Conditions in America are rapidly approaching those in Europe. When the lumber is all gone and the price of coal has doubled, then will both the gas and oil engines be run as well as in Europe.

S. N. RUSHMORE.

President, Rushmore Dynamo Works, Plainfield, N. J.

Why the Entropy Confession?

This is the hour when the departure from well worn paths of customs, etiquette and convention is called progression. Politically such departure is known as "insurgency," and the movement has become so popular that it has extended to other walks in life. Now and again some well known and respected practitioner of medicine will publicly declare that the bathing is injurious; another will announce that sleeping in rooms with windows open is a fad; then again some college president will rise against our institutions, and a professor will "confess." This insurgency indicates a healthy desire to get at the truth, and for this reason these movements are encouraging; the difficulty is that the public press of the country seizes upon these expressions and all too frequently exploits them as established facts. And, it must be confessed, it too frequently happens that the desire for publicity causes these insurgents to rush into print with their ideas but half baked.

When a journal with the standing of the AMERICAN MACHINIST will give space to an article such as the "Confessions of a Professor," by Entropy, page 439, and editorially state that it deals with the question of actually earning the salary in a humorous manner which may contain several grains of truth, it would seem that the journal was catering to that element which has always sneered at education.

There is very little doubt in the mind of any fair-minded man about the professor earning his salary. The average professor who has to meet his classes 15 hours a week will probably work more hours than the average brick mason. No one ever judges the amount of work a lawyer does by the time he spends in court; nor should a teacher be judged by the amount of time he spends in class. Time for preparation, for investigation and for administrative work will require more time of a teacher who teaches 15 hours a week honestly than an eight-hour law would permit.

The complaint about low salaries is not so much an objection on the part of the professor to his remuneration as it is the expression of a desire on the part of our institutions to get the best men possible. To attract better men into teaching and to keep the best men, institutions must be able not necessarily to make teaching a financially attractive profession, but certainly they must be able to make it financially possible. Partly because they are unable to get genuine teachers always and partly because of their peculiar business administration, institutions are apt to tolerate incompetence longer than they should. With a higher scale of salaries it would be possible to get more good men, and certainly none but the best should be engaged in the teaching of the youth of a nation.

Entropy asks why, if the pay is so poor, professors do not leave their chosen work and accept the $3000 and $4000 positions they are training their students to fill. It must be patent that those of his kind usually do if they are not too lazy and incompetent; and the profession of teaching gains thereby. There is something in teaching, something beyond and above mere financial considerations, and it is plain that he has missed it. It might also be suggested that education never made a $4000 man out of a $1500 one. An education, of no matter what kind, will not pull up nor push down a man above or below that station in life for which he is fitted by reason of his ability. Education will train him to reach his station quicker, and will enable him to enjoy it more, but it cannot "make a silk purse out of a sow's ear."

Iowa City, Iowa. F. G. HIGBEE.

Predecessors of Watt's Engine

I have read with much interest the article "The Predecessors of Watt's Engine," on page 479. The old engine therein described as at work at the Farme Colliery, near Rutherglen, is well known to me and it may interest your readers to know that it dates from the year before the battle of Waterloo and has been in constant use ever since. The cylinder was never bored out—all that was done to fit it for use being to polish the inside by drawing backward and forward through it by cords a block of lead which was charged with emery and oil. The arms of the flywheel and the connecting rod are made of wood and the valve gear is moved entirely by hand. I saw it doing its work quietly two days ago. It looked as if it would outlast its duties and only cease working when the mine is wrought out. It is a most interesting survival of old engineering times and well worthy of a visit by any one of an antiquarian turn.

Glasgow, Scotland. WM. BEGG.

Thirteen towns and a large number of landed proprietors were represented at a recent meeting at Minsk, Russia, which petitioned the government for a concession to build a 570-mile railway from Brajansk to Grodno, opening up a large territory to agricultural and industrial development.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., m. b. H., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.

CIRCULATION STATEMENT

During 1909 1,209,000 *copies. For November,* 1910 *(American weekly, American monthly, English weekly and German weekly), total,* 121,750.

December 1..... 42,000

None sent free regularly, no returns from news companies, no back numbers.

Contents

PAGE

Electrically Welded Vehicle Wheels.... 997
Trade School Teachers and Costs..... 1000
Making a Cam for Computing Machine 1002
Tools at the Springfield Armory..... 1003
How Would You Do This Work?..... 1006
Special Tools Used on Injectors..... 1007
Tees for Shafts..... 1008
Tools for Textile Machines..... 1009
Hardening Steel with Electricity..... 1010
Lighting a Large Iron Foundry..... 1011
Education of the Apprentice..... 1013
An Old English Grain Roll Fluter..... 1014
Grinding a Hole in a Large Cam..... 1015
Manufacturing on the Engine Lathe.... 1016
An Outline of Lock Development..... 1018
A Railroad Educational Bureau..... 1019
Making Things—Saving a Belt..... 1021
Letters from Practical Men:
Air Traverse for Heavy Tail Stock ....An Improved Rivet Spinning Tool....The Hight Gage and Accuracy....Air Hammer for Railway Shops....Keeping up with the Profession .... Some Millwright Troubles .... Punching Lugs on Small Tubes....Magnetic Tee Square ....Backing Off Attachment for the Worm Miller .... Silencing Gear Wheels....Method of Securing Cutters .... Measuring Metric Screw Threads .... Gage Grinding Fixture 1022-1028
Discussion of Previous Question:
Which End of a Piece Should be Made First?....The Diesel Motor Failure....Why the Entropy Confession? 1029-1030
Manufacturers and Industrial Education 1031
About the Diesel Engine.....1031
Copying Machine Tools and Appliances 1032
Educating Employees..... 1033
New Tools and Machine Shop Appliances 1035

American Machinist

Editorial

Manufacturers and Industrial Education

The one discouraging feature of the Boston convention of the National Society for the Promotion of Industrial Education lies in the fact that it was attended by so few representatives of manufacturing interests. The contrast, in this respect, between this and the first convention of the society is both striking and discouraging. While the educational element has always predominated at the conventions, it is nevertheless true that, in former days, manufacturing interests were represented by a large and active delegation. The situation is the more unfortunate because of the lack of faith of manufacturers in the ability of the educators to direct the movement successfully. Plainly, however, if the manufacturers refrain from attendance at the conventions and by their own act throw the society into the hands of the educators, they are by that act estopped from criticizing the results to which the activities of the society lead.

The situation is the more surprising because at the meetings of associations representing various manufacturing interests, the subject has for several years occupied the leading place on the programs. Moreover, the manufacturers have shown their interest by activities which have led to the actual establishment of industrial schools, in which work they have been the leaders to the extent that, as reported elsewhere in this issue, the recent convention consisted very largely of reports describing work for which manufacturers are chiefly responsible.

The situation may, perhaps, be due to a prevailing feeling among manufacturers that the situation is one demanding action rather than discussion; although in view of the discussions in their own associations this view is scarcely tenable.

While we have some sympathy with the idea that the situation demands action rather than discussion, meaning by "discussion the kind of discussion that has heretofore prevailed at the conventions, it must be recognized that that discussion was a necessary preliminary, and that the society, now having tangible achievements before it for discussion, such discussion is in the highest degree useful.

In spite of the doubts which prevail regarding the capacity of educators to direct this movement wisely, we are bound to say that, when judged by the progress made, no one can criticize the management of the society by the educators.

Not only did they, at the recent convention, insist and insist over again on the necessity of manufacturers' coöperation but, as a result of their management of the affairs of the society, it has held a convention which, we believe, will in future, be regarded as epoch making in the history of the movement. Had the educators turned their backs upon the society as the manufacturers have done, it would not now be alive, and whatever influence it now has or which it acquires in the future, must be placed to the credit of the educators.

The breadth of mind of the educational element was further and conspicuously shown by their action in electing manufacturers as both president and vice-president for the ensuing year. While we are not authorized to speak for these gentlemen, we have no doubt that one line of their activity will be an effort toward reënlisting the interest of manufacturers. The society is now ripe for a great forward movement of this kind. With the record of a great convention behind it, devoted largely to a discussion of things which manufacturers have done, and with manufacturers, as officers, guiding its activities for the ensuing year, that year should see a growth of influence and material prosperity which will eclipse anything in the history of the movement.

About the Diesel Engine

The letter from Mr. Rushmore in another column throws an interesting light on the question of the success of internal-combustion engines in connection with producer-gas plants and also engines of the Diesel type.

While there is little question that engines of this type require better workmanship than was evidently thought necessary by the early promoters of the Diesel motor in this country, it is quite possible that they would have attained greater success had they devoted sufficient time to the proper training of men to handle the engines after they were installed. As is too often the case with a new machine of any kind which possesses great economical possibilities, we are apt to overlook the very essential feature of intelligent operators and fall into the common error of believing that they can run by low price or inefficient attendants.

It is also undoubtedly true that the for-

mer builders of the Diesel motor paid far more attention to the stock market than to the engineering possibilities of their product, with a result that the workmanship suffered and the engines gave trouble in many instances.

To be specific we may mention a case where one crankshaft after another broke in a very short time. Not until the broken cranks were replaced by a crank shaft from Germany, could the motor be kept running for any length of time. The plant is still running, however, and has been increased to three units, but German crank shafts are used in each motor. This is a case where only the persistent faith of the user prevented the motor from being declared an unqualified failure.

In addition to this, and showing what might have been obtained in most cases, a number of plants have been successfully operated for a number of years, their success being probably due to a combination of better workmanship than the average, and skilled attendants.

Now that the Diesel motor has ceased to be a football of finance and is being manufactured on an engineering basis, there is no reason why it should not attain a success as gratifying as has been the case in Germany. The present builders have announced their intention to carefully watch both the workmanship and the proper training of men to handle the engines after they are installed.

Copying Machine Tools and Appliances

We all advise accuracy in machine tools unless it is displayed in making a copy of another machine.

While really original machines are necessarily few and far between, there seems little excuse for making copies so exact that the original maker would have to look twice to be sure as to its identity—if indeed the actual originator could be found.

If we decide to build drilling machines for example, we would have to be considerable of a genius to so get away from the adopted form of machine as to not be justly accused of copying certain features from some one, perhaps from several. But if we can devise some means of driving or feeding that is a little different, perhaps a little better, we can feel that we have added a little at least, to the sum total of machine construction.

If however, we copy a machine in every detail, and to crown our accuracy in this respect, send out photographs from exactly the same point of view and have the same kind of a wrench in the same place on the floor, we can justly be accused of copying. Nor can we feel greatly wronged if under such circumstances we are accused of copying the other maker's photograph or catalog as well as his machine.

About the only source of satisfaction in such cases is the knowledge that those who depend on copying others, are usually at least one lap behind the game and seldom catch up with the procession. Really good mechanics rarely make very close copies of existing machines, regardless of whether patents have expired or not. They want something better and generally get it.

The best protection against such copying is to earnestly and persistently make yourself known as the manufacturer of your type of machines. Then any copy is recognized at once by critical buyers, for just what it is worth and advertises your product more than ever.

Octave Chanute

With Octave Chanute, whose death occurred on November 3, one of the most distinguished veterans of engineering in the United States, has passed away. The substantial work of his life during his more vigorous years was civil engineering upon railroads. To their upbuilding in this country he contributed much, at a time now remote, from which he has survived nearly all of his active contemporaries. He has died, however, in the fresh celebrity of a new career, a leader in the latest mechanical art—aviation.

Octave had been born, Feb. 18, 1832, six years before his father migrated to Louisiana from France. His education was largely given him at private schools and by private tutors. About 1849 he began his professional life as assistant chairman in the construction of the Hudson River Railroad. The chief engineer of the road at this time was John B. Jervis, one of the greatest names connected with early American railroading.

Young Chanute rose so rapidly that by 1853 he was division engineer at Albany, in charge of completing terminal facilities and maintenance of way between that city and Hudson. About this time H. A. Gardner, who had been chief engineer of the Hudson River road, went to Chicago to build one of the early Illinois railways, later merged into the Chicago & Alton, and Chanute went with him. The next 20 years of his life were spent on railroads in the Mississippi valley, where he was active in the construction and maintenance of the many lines which have since been swallowed up in the great systems.

At one time he was awarded a premium for a competitive design for a bridge across the Missouri river, at St. Charles, Mo., and in 1867 he went to Kansas City as chief engineer of the bridge across the same river at that point. The last mentioned was a pioneer bridge across the Missouri, and, owing in part to the difficulty of the stream, it earned for him no small reputation. He also, as the result of a competition was selected to build the Union stockyards at Chicago, and later, simultaneously with his railroad work, he designed and built the Union stockyards at Kansas City.

A new period in Octave Chanute's life opened in 1873, when he returned East to become chief engineer of the Erie railway. That road, having passed under new management, was then laying ambitious plans for extension, but the panic of '73 nipped them in the bud. One of the projects was to bridge the Hudson at Poughkeepsie, which subsequently has been done by another interest. In spite of its disappointments, the Erie retained Chanute in its service for 10 years and he made valuable improvements to it.

Mr. Chanute returned West in 1883 and in 1889 he opened an office in Chicago, where he devoted himself chiefly to timber preservation by chemical means, being president of the Chicago Tie Preserving Company, which had works at Chicago and Mt. Vernon, Ill.

In the late years of his life, he allowed play to an interest in the science of aëronautics and proved the hopeful possibilities of old manhood by building up for himself a new reputation as an authority in that difficult branch of mechanics. He engaged in experiments of his own and furnished means for the work of others. The fact that he served as an adviser to Wright Brothers connects him with the success of his pet enterprise. In 1894 he appeared as an author of a book "Progress in Flying Machines," and he was one of the writers of the "Pocketbook of Aëronautics."

Mr. Chanute was connected with various societies of civil engineers in this country and abroad; in 1881 he served as president of the American Society of Civil Engineers. As chairman of a committee from this organization, charged to study the rapid transit needs of New York City, he presented in 1875, a report which led to the building of elevated railroads on Manhattan island. He contributed to its proceedings, as to those of other societies, various papers upon engineering subjects.

In Peoria, Ill., 1857, he married Annie R., daughter of William James; at a comparatively recent date three daughters and one son were surviving.

Warren D. Huse

Warren D. Huse, prominent in the manufacture of knitting machinery, in which he has been engaged in Laconia, N. H., since 1878, died in that city on November 20. Mr. Huse was a native of Vermont and began life as a machinist. He was for a number of years foreman in the shops of Nathan Baldwin, and during his career as a manufacturer invented a number of machines that have become standards.

Industrial Education Convention

Editorial Correspondence

An enthusiastic meeting results from the presentation of papers describing work that has been done.

The fourth annual convention of the National Society for the Promotion of Industrial Education, held in Boston, November 17, 18 and 19, was by far the most successful in the history of the society. Measured in any way that is possible—by the character of the papers, the number in attendance, or the sustained interest in the proceedings—the society has held no meeting that compares with this.

The Attendance

Basing their action on the experience of previous meetings, the committee had selected for Thursday's sessions a hall which proved to be entirely inadequate. Not only was it crowded to suffocation, but large numbers were turned away on account of the impossibility of getting in. The result was a hasty removal to another hall of two or three times the capacity of the first for the afternoon session, and even this was well filled. The sessions of Friday were equally well attended, although those of Saturday were not, and in the difference in character of the papers read at these sessions lies, no doubt, the explanation of the greatly increased attendance at this convention as compared with previous ones.

The sessions of Thursday related to trade schools for girls, and those of Friday to similar schools for boys, the papers and discussions in both cases relating to schools which are established and to the work which they are doing. The morning session of Saturday was, on the other hand, given to the consideration of those general phases of the subject which have hitherto formed the staple of discussion at the society's meetings.

By this we mean that this session related to the social and economic significance of industrial education and to similar philosophic and general phases of the subject. It is to the last degree significant that the attendance at this session was not over half of that at the preceding sessions. This, moreover, is to be regretted, as, unlike some of the papers on this phase of the subject to which the society has listened in the past, those of this meeting were distinctly informative and highly interesting. They were from those who have been and are in personal touch with mill and factory conditions and were of a tangible, practical character quite equal to those upon actual educational work in progress.

Trade Schools for Girls

As we have already said, the proceedings of the first day related to trade schools for girls, more especially for the needle trades and department-store work, papers being read which described the work of schools which have been established in Boston and New York. The remoteness of the work from the field covered by the American Machinist is the only reason for passing these papers and the discussion upon them with a few general remarks. One could not but be struck with the thoroughly practical character of the work, and with the fact that it has been successful in increasing the usefulness and the earning powers of girls employed in the industries to which the schools relate. Naturally the work has been done chiefly by women, who were the leading speakers and who preponderated in the audience. The practical character of the feminine mind was perhaps never better illustrated than by the accounts presented of the manner in which women have undertaken and carried to successful results the trade education of girls.

A noteworthy feature of this session was the discussion of the papers by Walter A. Hawkins, of the Jordan Marsh Company, of Boston, and his unqualified indorsement of the value of the work.

The evening of Thursday was devoted to a public banquet, in accordance with the regular practice of the society at previous conventions. The banquet was attended by nearly 400 people. The speeches being largely by public men, without practical knowledge of the subjects discussed, were of less interest than the proceedings of the sessions proper and brought out but little of importance.

Co-operative and Corporation Schools

The morning session of Friday was devoted to apprenticeship and corporation schools, and the afternoon session of the same day to part time and evening schools. Despite the interesting character of the papers presented and the manifest interest of the audience, surprisingly little was said which is entitled to reproduction in these columns, for the reason that it was chiefly a restatement of facts that have already appeared in them.

Papers were read upon the apprentice school of the Westinghouse Electric and Manufacturing Company, upon the Fitchburg Coöperative School, the Beverly School and the industrial school work of Cincinnati, all of which have formed the subjects of articles which have been published in these columns. Other schools of which the plans were presented by special papers were those of the Atchison, Topeka & Santa Fe Railway and of the Solvay Process Company. While the work of the Santa Fe system has not been presented in these columns, the very similar system of the New York Central lines has been, and it will thus be seen how largely the work of the second day of the convention has been anticipated by the American Machinist.

It is not too much to say that the spirit of these schools captured the convention. The papers brought out the manner in which the public schools and manufacturers can coöperate by showing how they have already successfully coöperated, and, so far as the future of the society can be predicted from a single convention, it is safe to say that its activities in future will be largely, if not chiefly, devoted to the furtherance of this coöperation. The necessity for such coöperation was brought out again and again in the discussion, this being, in fact, the dominant note of the day's proceedings.

A Convert

Special reference should be made to the address on The Public Schools and the Apprentices of Cincinnati, by Frank B. Deyer, Superintendent of Schools of that city.

Mr. Deyer is an example of an old line educator, who has been absolutely converted to the new educational idea by what he has seen of it in actual operation. The zeal of a new convert is proverbial, and while this psychological fact is sometimes referred in a derogatory sense, it deserves reference here in a very opposite sense. Mr. Deyer grew fairly eloquent in his account of the quickening of the interest of the boys in their school work, because of its obvious leading to tangible results. He is plainly marked out by his experience, his conversion, and his aptitude as a public speaker as an evangelist to carry the new gospel among old line educators. If the revenue of the society is sufficient, it would be well justified in making an appropriation to defray the expenses of such activity.

Preliminary School Work

One of the features of this day's sessions, which has had no previous notice in these columns, relates to the preliminary training in the printing trade given by the North End Union of Boston. The printing school of this institution aims to provide one year's work, which shall apply toward a regular apprenticeship in a commercial printing office. The students are, in fact, indentured apprentices at

commercial printing offices, their first year, however, being spent in the school and not in the shops of their employers. Under present conditions they are required to pay a tuition fee of $100 for this first year, which in the discussion was referred to as an unfortunate feature.

The same idea of preliminary training was announced by Mr. Deyer as about to be incorporated into the industrial school work of Cincinnati. The idea is to bridge the gap between 14 and 16 years of age with high-school work, part of which shall be of a manual character, in order to enable the boys to begin work as apprentices with some preliminary training already acquired. Several speakers, including Mr. Deyer, referred to the failure of evening schools for apprentices, and to the essential unfairness of expecting boys to devote their evenings to school work after spending the regular shop hours in the factories. The difficulty of obtaining properly qualified teachers was dwelt upon by several, including Mr. Deyer, the general feeling being that from this standpoint alone the movement is progressing as rapidly as healthy growth will permit.

The discussion on corporation schools was summed up by G. M. Basford, of the American Locomotive Company, who regarded such schools as essentially a revived and modernized apprentice system, of which the central feature is deliberate teaching of trade operations. So far as the school part of this movement is concerned, it has a distinct value, which may or may not prove to be permanent. He believed that nothing could take the place of apprenticeship and that an increasing number take the same view. The school feature of the plan may, however, in his opinion, eventually give way to the continuation or coöperative plan. As an indication of the great need of better training in the trades, Mr. Basford stated that at a large works, whose name he did not give, the records showed that of those applying for work only 8 per cent. even professed to be able to do anything better than unskilled manual labor.

German Continuation Schools

The evening of Friday was given to an address by Dr. Georg Kerschensteiner, superintendent of schools, Munich, Bavaria, his subject being "The Continuation Schools of Germany." The lecture was given in the great lecture hall of the Massachusetts Institute of Technology, which was nearly filled by the audience. The continuation school time in Munich has now been extended from the prevailing practice of six, to nine hours per week, and a portion of this time is devoted to manual work in school shops, the aim being to supplement the one-sided work which characterizes apprenticeship in Germany as well as in this country and to give the apprentice experience on lines which he otherwise would not get. Doctor Kerschensteiner made it plain that these schools are based on and are supplementary to apprenticeship, and that in no sense do they supersede that system. So far as those present are concerned, this matter may now be regarded as fairly cleared up. This alone is a worthy object for the convention to have accomplished. In this respect again, the work of the convention has been fairly anticipated by the AMERICAN MACHINIST.

Doctor Kerschensteiner came to this country on the invitation of the society. His lecture has already been delivered in other cities and is to be heard by still other audiences, including the American Society of Mechanical Engineers.

The New Officers

As a final indication of the fact that the society has now passed the preliminary, though essential, stage of speculation and reached the stage of action, is the character of the men elected to office for the ensuing year. The new president is James P. Munroe, of Boston, and the new vice-president, F. A. Geier, of Cincinnati. Mr. Munroe is treasurer of the Munroe Felt and Paper Company, of Boston, and is a man of large activity in movements looking toward social and civic betterment. Mr. Geier needs no introduction in the columns of the AMERICAN MACHINIST.

Geometry in a Machine Shop

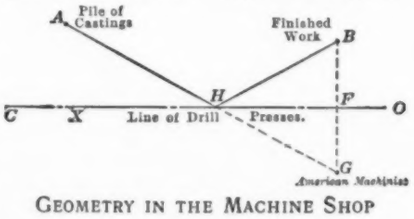
By Wesley McArdell

Bill Jones was an apprentice and in common with most of his kind, had a decided aversion to do any more work than was absolutely necessary. He possessed, however, a remarkable aptitude for mathematics and the various expedients employed by him to get around some jobs were worthy of better cause.

The latest product of his ingenuity is well worth while recording. The sketch shows the conditions and general layout of Bill's latest stunt. *A* is a pile of heavy castings. *C D* is a bank of drill presses, and *B* is where the castings were to be placed when drilled. The problem confronting Bill was which drill press entailed the least amount of walking. At first he reasoned that if he walked directly from *A* to a drill press at *X*, on *C D*, drilled the hole and walked from *X* to *B*, he would be covering the shortest distance. Several trials soon demonstrated that *X* was not the point desired.

Finally, when the job was almost completed, Bill hit upon the correct solution although he didn't claim any originality for it. He dropped a perpendicular (one of his mates almost dropped when he was demonstrating the solution) from *B* to *C D*, and prolonged it on the other side of *C D*, a distance equal to *B F*. He then drew straight line *A G*. He reasoned that the triangle *H B G* was isosceles, and that *H G* was equal to *H B*.

It was evident (to Bill at any rate) that *A G* was the shortest distance between points *A* and *G*, and it was also plain that as *H G* was equal to *H B*, it followed that the point *H* was the spot on the line of drill presses that Bill was looking for.



Geometry in the Machine Shop

International Exhibition of Novelties and Patents

The National Association of Hungarian Ironmongers has organized an International Exhibition of Novelties and Patents of the iron and engineering industry, to take place in the Industrial Palace, in Budapest, during May and June, 1911. As stated by the prospectus it has for its purpose the exposition of novelties and patents developed during recent years in the iron and engineering industries. The promoters of the exhibition point out that it will offer to ironmongers the opportunity of extending their business fields by the sale of new articles and will open to manufacturers arrangements for manufacturing articles which have hitherto not been made in Hungary and which promise an important sale.

The principal articles to be exhibited are ironware, machines and apparatus for domestic uses, industrial and agricultural plants and motor engines. Models or designs of new heavy machines can also be exhibited. Joseph Baneth, of Budapest, Hungary, who is interested in promoting this exposition, is now in this country, and is to remain a few weeks at the Herald Square hotel, New York. City.

Panama Canal Lock Gates

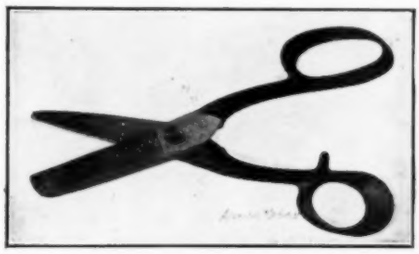
For the 46 locks on the Panama canal, there will be 92 gate leaves. The leaves will be hung from the canal sides, meeting in the center when closed, and each leaf will weigh about 600 tons; will be 65 feet wide by 77 feet high and 7 feet thick; composed of girders and steel plating, with interior air chambers. The plating will be 7/16 inch thick at top, increasing to 13/16 at bottom.

New Tools and Shop Appliances

Scissors for Belting, Packing etc.

The cut shows a pair of scissors for cutting leather, rubber, packing, linoleum, etc., which is being put on the market by Schuchardt & Schütte, 90 West street, New York. The upper blade is a regular shear blade but with a longer handle than usual to give greater leverage.

The trouble with the ordinary scissors when cutting the materials mentioned is that the goods being cut is apt to be



SCISSORS FOR BELTING, PACKING, ETC.

pushed along the blades instead of being cut. This is overcome in these scissors by having the edge of the lower blade serrated so that it prevents the material from slipping while the upper blade does the cutting.

These shears, known as "cogged scissors," are made in two sizes, 8½ and 11 inches respectively, and they will cut single-ply leather belting as easily as the ordinary scissors will cut cardboard.

A Chuck for Oval and Cylindrical Work

The halftone shows a chuck for turning oval and cylindrical work such as dies, hubs, chucks, molds, patterns, etc., designed and constructed to fill the requirement of the makers of tools for the silverware and fancygoods trades.

The general construction of the chuck is on the cross slide eccentric ring principle with a 15-inch 4-jaw chuck.

The variation of oval shapes obtainable is from 0 to 4 inches.

The anchor slide with the gear box and eccentric slide is straddled across the spindle. It has long bearings and is rigidly constructed.

The square-threaded screw operating the eccentric slide and the worm screw driving it is very large. The worm-screw shaft protrudes from the gear box parallel with the main spindle of the lathe and is arranged for either hand or power feed.

This arrangement of feed on the chuck enables the operator to adjust the oval

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

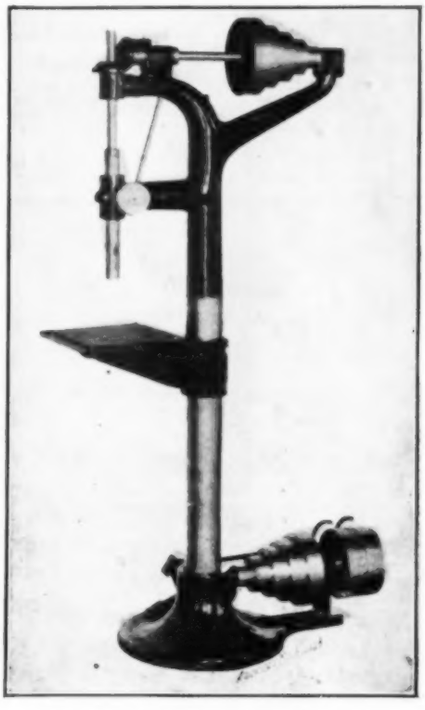
A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

turnings, say from a given minor and major diameter and to feed evenly with the cross feed or carriage on lathe and come into a round center or given oval by changing the gear feed on the worm screw.

This is especially valuable in turning out dies with different ovals and obtains a geometrically perfect shape of the design. This chuck is made by J. A. Moller, New Rochelle, N. Y.

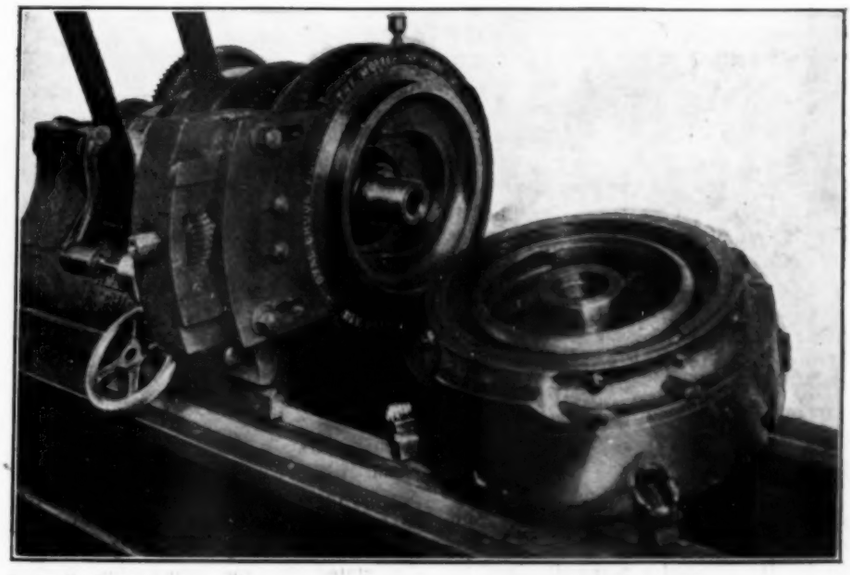
A 16-inch Sensitive Drill

The halftone shows a drill just put on the market by the Sibley Machine Tool Company, South Bend, Indiana. This machine



A 16-INCH SENSITIVE DRILL

has self-oiling bearings throughout. The spindle is not counterbalanced but held in any position by a brass friction. It is driven by miter gears which run quietly



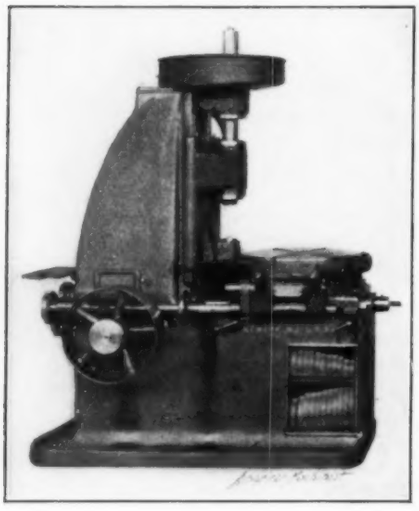
A CHUCK FOR OVAL AND CYLINDRICAL WORK

at the highest speeds. The base is of ample proportion. The countershaft runs at 500 revolutions per minute, and gives five spindle speeds, 150 to 1700 revolutions per minute. The weight of this press is 300 pounds.

The Gould & Eberhardt Continuous Milling Machine

The halftone shows a continuous vertical milling machine manufactured by Gould & Eberhardt, Newark, N. J., for the use of high-speed steel milling cutters on duplicate work to accomplish rapid production and the elimination of any waste time by a continuity of action.

The main body of this machine is in



GOULD & EBERHARDT CONTINUOUS MILLING MACHINE

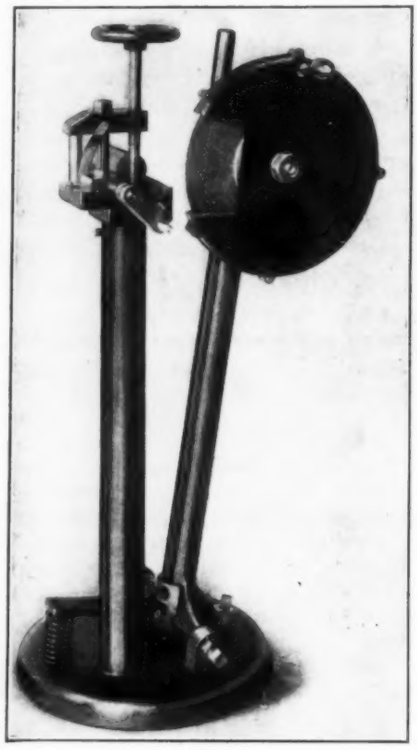
one piece strong and rigid. The revolving work table is integral with the worm wheel which lies just below the table. The worm which engages this worm wheel is of coarse pitch and is made of high-carbon steel hardened and ground. The worm can quickly be disengaged from the worm wheel and the table revolved by hand. The table is direct gear driven and has from 4 to 14 inches per minute circumferential changes of feed to the work, the changes being derived by means of change gears.

The spindle is of large diameter, and is made of chrome nickel steel, runs in bronze bearings and has hardened and ground steel thrust washers. The spindle is threaded on the end to accommodate end- or face-milling cutters, and also has a slot or keyway for driving. The spindle is arranged to receive the ordinary taper-shank cutters and is provided with a draw bar through the center of the spindle to draw the taper-shank cutters.

The main spindle slide which is in one piece with the bearing, is long and rigid and may be adjusted vertically. On its extreme bottom end it contains an outer support for the spindle, which support can also be adjusted vertically, independent of the main slide.

Elastic Wheel Metal Cutting Machine

The halftone shows a machine which is being put on the market by Nutter & Barnes Company, Boston, Mass. It carries an elastic emery wheel 12 inches diameter by 3/32 inch thick running at 3000 revolutions per minute. It will cut pipe up to 3 inches diameter and solid



ELASTIC WHEEL METAL-CUTTING MACHINE

steel, hard or soft, up to ¾ inch diameter very rapidly.

The material to be cut is placed in the V rest and the wheel is swung into the work.

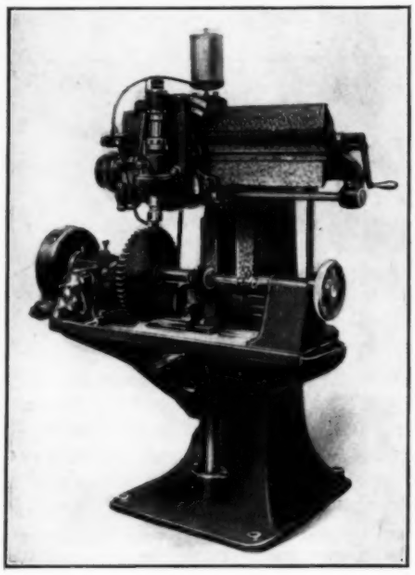
A New Radiation Pyrometer

The Brown Instrument Company, 311 Walnut street, Philadelphia, Penn., has recently brought out a new pyrometer of the fixed focus type. This pyrometer has a finder somewhat similar to those used on kodaks which has been placed on the tube, and by means of this, the tube can be readily pointed directly at the furnace opening. It also acts as a measure of distance, and it is only necessary that the bright red of the furnace opening takes up the whole view in the finder. If some of the dark outside wall of the furnace is showing around the bright red opening, the tube is too far distant, and should be moved closer until the bright red only is showing. The instrument is accurate under ordinary working conditions within 1 per cent. or 30 degrees at 3000 degrees Fahrenheit.

A Tooth Rounding Machine

The halftone shows a tooth chamfering machine, built by J. E. Reinecker, Chemnitz, Chemnitz, Germany, and handled in this country by the Carpenter-Kerlin Gear and Machine Company, 77 White street, New York.

The machine is built in two sizes swinging gears 15 and 19¾ inches di-



A TOOTH-ROUNDING MACHINE

ameter, and taking 23½ and 29½ inches between centers respectively.

The machine is very massive, the smaller size weighing 1760 pounds and the larger one 3520 pounds.

The chamfering is done by a rapidly rotating end mill shaped like the curve of a tooth which follows a radial path around the end of the tooth. The machine can also be used for drilling and slot milling.

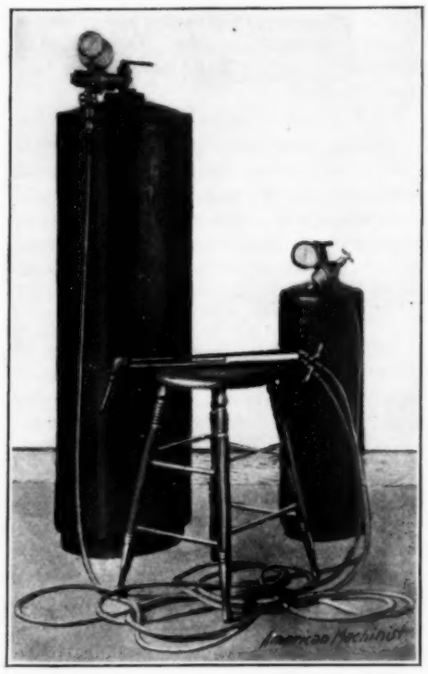
The Astra Welding Outfit

The halftone shows the Astra oxy-acetylene welding outfit which is manufactured by Alton, Laine & Co., Long Island City, N. Y.

The device is portable and will handle all classes of welding and heating from the smallest up. Recently a 4-ton water-jacketed dynamo main bearing was successfully welded with this appliance. The bearing had cracked, and to complete the weld and fill the crack, 45 lb. of cast-iron feeding sticks were melted into it

It comprises one oxygen storage tank, with key and valve; on acety-

lene storage tank, with key and valve; one oxygen reducing regulator, with two gages; one acetylene reducing regulator, with two gages; one oxygen safety device; one acetylene safety and purifying



THE ASTRA WELDING OUTFIT

device; one welding torch with 10 tips from No. 1 to 10; 24 feet of high-pressure hose; one pair Hallau chemical-ray goggles; two S-wrenches.

Seneca Falls 14-inch Quick Change Feed Lathe

The Seneca Falls Manufacturing Company, 687 Water street, Seneca Falls, N. Y., has brought out a new 14-inch quick-change feed engine lathe, shown in Fig. 1. The quick-change feed mechanism consists of a cone of eight steel gears, located on the lead screw in right-hand side of feed cage; connection with any one of the eight gears is made by tumble yoke and gears from the lower shaft, which is given three changes of speed through another tumbler and set of gears in left-hand end of cage; by means of a lever on end of headstock two different speeds are imparted to the set of gears in the left end of the cage, giving the lead screw, which also is used for a feed rod, 48 changes. All standard threads from 1½ to 92 per inch, including 11½, and feeds of 0.0023 to 0.144 inch per revolution of the spindle are given on the index plate, clearly showing how to instantly obtain any desired thread or feed.

The micrometer stop, Fig. 2, for the cross slide receives its name from the micrometer feature, by which minute adjustments are easily made. The relative

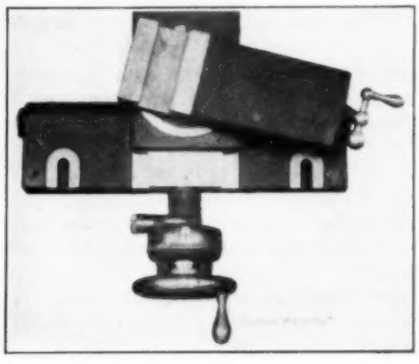


FIG. 2. MICROMETER STOP FOR CROSS FEED

positions of the stop are changed through a worm gear operated by the screw with the nurled knob, and allows the tool to advance as indicated by the graduations on micrometer barrel. The graduations are about ⅛ inch apart and read in 0.00025 inch. The stop mechanism is thrown in and out of engagement by pushing in and out the knob inside the hand wheel. The stop acts directly on the cross-feed screw. The tool may be fed away from the work as far as desired and when returned will stop as indicated by the graduations. This stop is positive, capable of cutting accurately to a given depth for both outside and inside work and may be used with the taper attachment.

The reverse mechanism for both cross and longitudinal feeds and lead screw consists of a set of spur gears and clutch in headstock, operated through levers connected by a reversing rod to a hand lever on the apron. It does away with the necessity of reverse belt on the countershaft and gives 16 forward speeds to the spindle. An automatic stop for the carriage operates in either direction, right or left, by means of adjustable stops on the reverse rod.

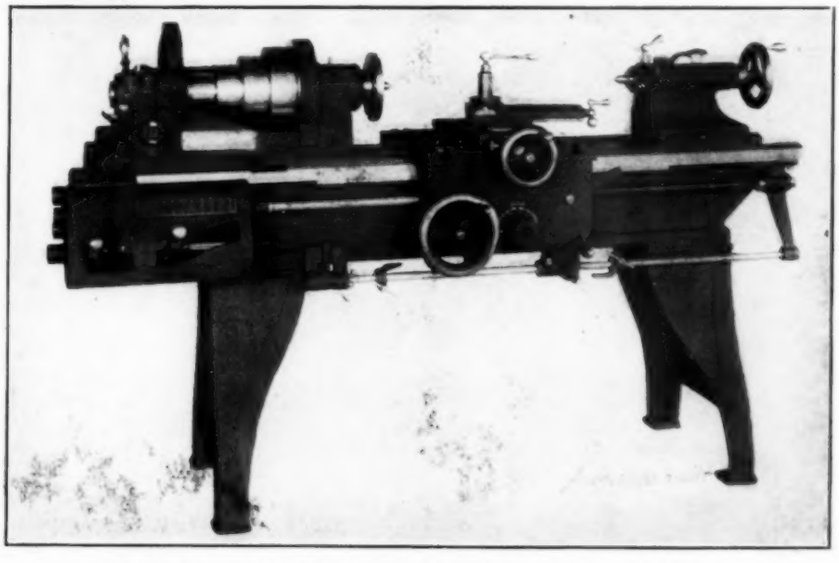
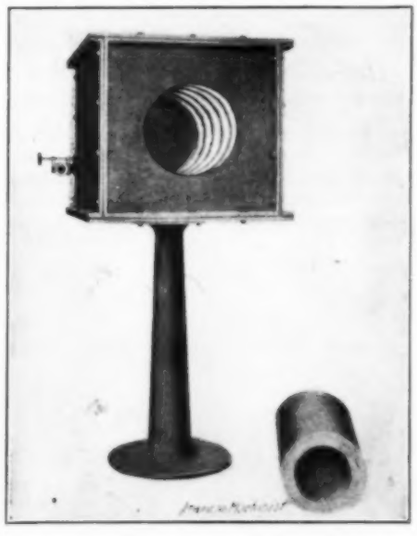


FIG. 1. SENECA FALLS 14-INCH QUICK-CHANGE ENGINE LATHE

High Speed Furnaces for Oil

The halftone shows a fuel-oil burning muffle furnace for high-speed steel, built by Bellevue Furnace Company, Detroit, Mich.

The grooving shown in the brick lining serves as the flue which carries the flame from the inlet to the outlet of the furnace in a continuous spiral form. The



A HIGH-SPEED FURNACE USING OIL FUEL

spiral remaining between these grooves presents a complete support to the muffle shown on the floor.

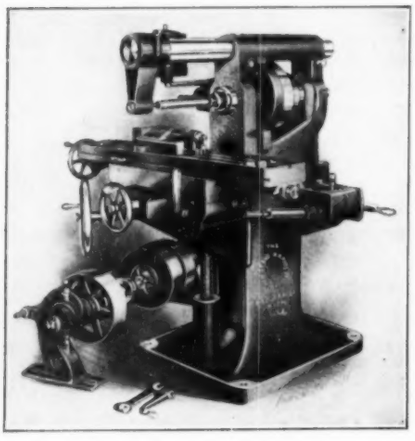
There are certain forms of steel which the necessarily extreme heat is liable to warp when treated in a horizontal furnace, and the position of this furnace can be easily changed from horizontal to vertical. One furnace is thus practically the equivalent of two separate furnaces.

A Plain Milling Machine

The halftone shows a plain milling machine which has just been put on the market by the Grand Rapids Machine Tool Company, Grand Rapids, Mich.

The table is 32 inches long by 8 inches wide and has three T-slots. The saddle is 22 inches in length.

The feed box gives 12 changes of

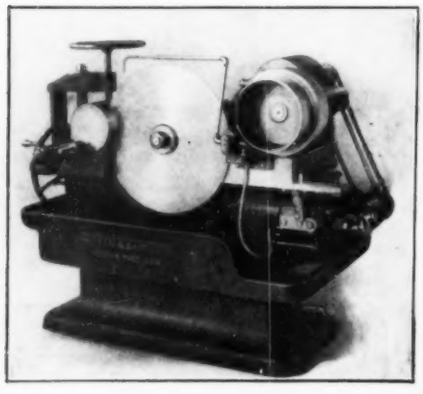


A PLAIN MILLING MACHINE

feeds by sliding gears. The power travel to the table is 24 inches, cross traverse 8 inches, vertical traverse 18 inches. The machine is furnished with friction countershaft, wrenches, vise and an oil receptacle. The machine weighs 2000 pounds.

8-inch Cold Sawing Machine

The halftone shows a cold saw made by Nutter & Barnes Company, Boston, Mass. The machine is surrounded by a large



8-INCH COLD-SAWING MACHINE

drip pan to catch chips and lubricant. The spindle carries a 22-inch saw and is of large diameter. The back-gear ratio is 43 to 1. Four changes of geared feed from ½ to 2 inches per minute are provided. The feed driving sprocket is held between two friction disks to admit of its slipping, should too much load be put on the feed, or the feed stop not be set to trip at the right time. The feed is thrown in from a foot lever at the front of the machine, not shown in the cut, the treadle rod extending through to the rear of the machine near the oil-supply tube shown and operates on the worm shaft to connect with the feed worm wheel.

Automatic Thread Milling Machine.

In the accompanying halftone is seen one of two sizes of thread-milling machines now put upon the market by Schuchardt & Schütte, of New York City. The machine will cut single or multiple threads and spiral gears up to 10 inches diameter, 45-degree angle and 20-inch lead, either right or left hand. A positive locking index head is incorporated, for cutting from 1 to 40 teeth or threads. The machines are fully automatic and, for the two sizes the following dimensions are given: Maximum diameter that can be milled, 9 inches and 12 inches; longest possible thread, 16 inches and 20 inches; lead range ¼ to 20 inches, for either.

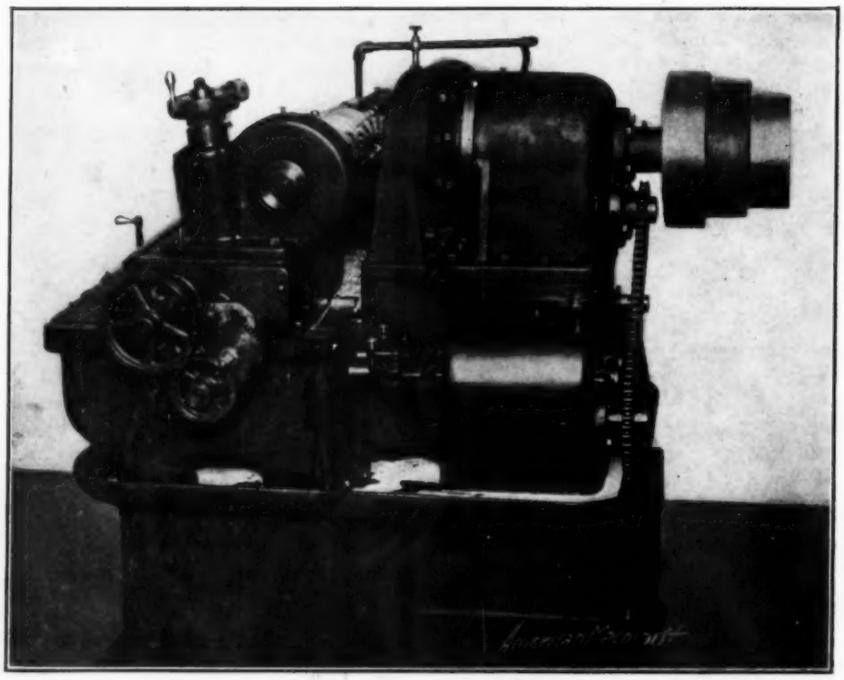
Twenty geared feeds are provided, giving a feed of 0.01299 to 0.05236 inch per revolution of the cutter. The usual automatic trips are provided, and if desired a special head spindle can be furnished with a hole up to 3¼ inches diameter to accommodate shafts passing through, the standard machines being made with a spindle hole 1 15/16 and 1¾ inch, respectively.

For usual leads both faces of the thread are cut at once, but for odd leads the machine may be automatically set to cut one face at a time.

A simple method of making service tests of the relative values of different lubricating oils, where oil-testing machines are not available, is given in a paper presented to the National Association of Cotton Manufacturers as follows:

Place a thermometer in a bearing that is running under constant load and speed, such as the main bearing of a high-speed engine, so that the bulb rests on the shaft, and maintain a constant feed of oil. Have another thermometer placed somewhere in the room near the bearing and out of drafts, so as to show the temperature of the room.

Commence the test when the engine is started, note the rise of temperature at frequent intervals, and also that of the room. Continue the test until the temperature of the bearing ceases to rise. Every bearing will in the course of a few hours reach a point where the heat is radiated as fast as it is generated. Deducting the temperature of the room from that of the bearing will give the temperature due to friction. If the engine runs in the daytime only, the bearing will cool off during the night. The next day repeat the test with another oil. These data may be plotted on diagram paper so as to show graphically the different rises in temperature with various lubricants. While it is no doubt true that in experimental work it has been found that the coefficient of friction often decreases with rise of temperature, yet in every-day practice it is safe to assume that of two oils the one that will keep the bearing the cooler is the best.



AUTOMATIC THREAD-MILLING MACHINE

Increasing Shop Capacities

METAL WORKING

NEW ENGLAND

The Waite-Thresher Company, Providence, R. I., is erecting a jewelry plant.

The tinsmith shop of J. Fields, Jamaica Plains, Mass., was destroyed by fire.

The plant of Cornell-Andrews, Attleboro, Mass., jewelry refiners, was destroyed by fire.

Marks & Gayle, Montgomery, Ala., have awarded contract for the erection of a garage.

The Litchfield Shuttle Company, Southbridge, Mass., will erect additions, including garage.

The jewelry plant of Riley & French, North Attleboro, Mass., was badly damaged by an explosion.

Eugene G. Mergenthaler will erect a machine shop at 116 Hollingsworth street, Baltimore, Md.

The T. W. Lind Jewelry Company, Providence, R. I., is to make extensive alterations to its plant.

The Boston & Maine Railroad roundhouse, at Nashua, N. H., was destroyed by fire. Loss, $75,000.

E. J. Davis, Burlington, Vt., is enlarging his jobbing-machine business by the erection of an addition.

A new building is being erected at the plant of the Davis & Furber Machine Company, Lawrence, Mass.

The Osgood-Bradley Car Company, Greendale, Mass., is to have several additions added to its plant.

Harry Widmeyer, Jr., will establish a factory in New Bedford, Mass., for the manufacture of loom reeds.

Fire destroyed the blacksmith shop and damaged the machine shop of Knowlton Brothers, Rockland, Me.

The Brien Heater Company will locate a factory at Westfield, Mass. It will include a machine shop and foundry.

Joseph Kavanaugh Company, Baltimore, Md., will erect a coppersmith shop at Pratt street and Central avenue.

A grain storehouse and repair shops of the Boston (Mass.) Ice Company was destroyed by fire. Loss, $20,000.

The Woonsocket (R. I.) Machine and Press Company has completed plans for additions to its foundry and machine shop.

The Metz Company, Waltham, Mas., manufacturer of motor cars and aëroplanes, is to locate a factory at Southbridge, Mass.

L. W. Lind & Co., manufacturing jewelers, of Providence, R. I., are considering a proposition to double the capacity of their plant.

The Brightwood Motor Car Company is to erect a factory at Springfield, Mass. It will be the largest motor-car plant in the East.

The Sarasota (Fla.) Garage and Car Company has been organized by J. B. Turner. Contract has been awarded for the erection of a garage.

The Deane Steam Pump Company, Holyoke, Mass., has had plans prepared for the erection of another addition to be used as a brass foundry.

The United States Signal Company, Newton, Mass., will erect a two and one-half-story addition to be used as a machine shop and for storage.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Alden-Sampson Manufacturing Company, Pittsfield, Mass., is to incorporate with $2,500,000 for the manufacture of airships and automobiles.

The Roberts Manufacturing Company, Somerville, Mass., making bolt clippers, has moved to new quarters at Beacon and Park streets and will add new machinery.

The Griest Manufacturing Company, Westville, Conn., making sewing-machine attachments, will enlarge its plant. New screw-machine equipment will probably be needed.

The Gilbert & Barker Manufacturing Company, Springfield, Mass., making gas furnaces, oil burners, rotary air compressors, etc., is endeavoring to secure suitable location for a new plant.

The Great Southern Automobile Company, Birmingham, Ala., has increased its capital stock from $100,000 to $500,000. Will increase machine-tool equipment and install brass and iron foundries.

The New York, New Haven & Hartford Railroad will make improvements at the Concord, N. H., shops, including an addition to the erecting room, new boiler shop and mill room, the installation of a massive electric crane and modern machinery in both old and new structures.

MIDDLE STATES

Henry Brown, Chippewa Falls, Wis., will erect a machine shop.

Damascus Brake Beam Company, Cleveland, Ohio, will erect a power plant.

The Sabin-Curtis Machine Company, Cleveland, Ohio, is building a new shop.

Schooley & Saxon are building a machine shop on Broadway, Harrisburg, Tex.

The Rochester (N. Y.) Can Company is having plans made for a new addition.

The Brady Brass Company, Jersey City, N. J., is planning to erect a new factory.

The Marshall (Mich.) Furnace will erect a two-story shop, foundry and office building.

The Sedgwick Machine Works, Poughkeepsie, N. Y., is considering the removal of its plant.

The Babcock Electric Vehicle Company, Cleveland, Ohio, is maing an addition to its garage.

The Morris Climax Boiler Company, of Brooklyn, N. Y., will erect a plant in Jersey City, N. J.

The repair shops of the Zanesville Coal Company, Croaksville, Ohio, were burned. Loss, $5000.

The plant of W. H. Howell Company, Geneva, Ill., manufacturing sad irons, was destroyed by fire.

Osten & Steinbrenner, Chicago, Ill., manufacturers of locomotive cranes, will move to Huntingdon, Ind.

The Dover Boiler and Construction Company, Canal Dover, Ohio, will make improvements to its plant.

The Sunray Stove Manufacturing Company, of Delaware, Ohio, is considering establishing a plant in Tulsa, Okla.

Work has been commenced on a new plant for the Scranton Electric Company, on Pike street, Carbondale, Penn.

The Cincinnati (Ohio) Traction Company, it is said, will commence work soon on new car shops in Winton place.

The McKinley Training School, Washington, D. C., is making additions. New mechanical equipment will be needed.

Bartlett Brothers Company, Cleveland, Ohio, manufacturing heating devices, is endeavoring to secure site for a new plant.

S. P. Hertzler, Box 1236, Pittsburg, Penn., would like prices and data on machines for making pipe joints and fittings.

A. D. Meiselbach, of North Milwaukee, Wis., is forming a company to have $100,000 capital to manufacture bicycles.

Medhus-Pihl Manufacturing Company, Hastings, Mich., will equip a factory for the manufacture of pinchers and pliers.

The Badger Automobile Company, Columbus, Wis., it is said, will add to its manufacturing equipment in the spring.

The Boyne City, Gaylord & Alpena Railway will rebuild shops, foundry and roundhouse recently burned at Boyne City, Mich.

The J. A. Fay & Egan Company, building woodworking machinery, will erect a large plant at Avondale, Cincinnati, Ohio.

The Michigan United Railways, Lansing, Mich., will install a complete machine shop for repair work in connection with new car house.

Work will be commenced at once on the plant of the Midvale Steel Company, Nicetown, Penn. Equipment has not yet been purchased.

The Simplex Motor Company, 1860 Broadway, New York, is looking for site in New England on which to erect a modern automobile plant.

The Joliet (Ill.) Rolling Mill Company has been incorporated with $150,000 capital to take over the plant of the Iron Products Company, which has been shut down for some time.

A contract has been awarded for the erection of a plant near Portsmouth, Ohio, for the Heer Engine Company, of Portsmouth, where all kinds of engines will be manufactured.

The Quiggle Auto Company, Cleveland, O., has been incorporated to operate a garage and repair shop. Incorporators, C. V. Quiggle, Samuel L. Henry, Charles S. Crasky, etc. Capital, $10,000.

The United States Automatic Operating Company, Mountaindale, N. Y., has incorporated to manufacture and deal in vending machines. Capital, $50,000. Incorporators, E. J. Forhan, H. P. Jones, D. A. Cashin, New York.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will receive bids December 6, for one engine lathe, one milling machine (schedule 3074), one triple

geared engine lathe, two lathes (schedule 3074).

The Automobile Manufacturing and Engineering Company, Detroit, Mich., is planning the erection of a factory on Harper avenue. A new type of gasolene motor will be manufactured. R. H. Evans is secretary and treasurer.

The McTammany Company, New York, has been incorporated to manufacture automatic musical instruments, pianos, etc. Capital, $150,000. Incorporators, Mars E. Wheeler, 32 Broadway; G. M. Barlach, F. Knowles, 45 Broadway.

The Standard Welding Machine Company has leased a building at 951 Main street, Buffalo, N. Y., which will be equipped for the manufacture of metal specialties. Thomas Muffit, formerly of the National Welding and Machine Company, is president.

The Columbus Engineering and Equipment Company, of Columbus, Ohio, was incorporated with a capital of $25,000, by C. V. Trott, E. E. Bridgeman, G. S. Napier, J. H. Kenefick and G. W. Shartle for the manufacture of steam and gasolene engines. A plant will be opened in Columbus.

WEST OF THE MISSISSIPPI

Jos. Weepie's blacksmith shop, at Ethan, S. D., was burned.

Sack & Grams' blacksmith shop, at Marmarth, N. D., was burned.

The Crown Iron Works, Minneapolis, Minn., were burned. Loss, $85,000.

The Laramie (Wyo.) Rolling Mills were destroyed by fire. Loss, $75,000.

The Zierath Combination Drill Company, Los Angeles, Cal., is building a machine shop.

The Commodore mine, at Virginia, Minn., will erect a machine and blacksmith shop.

The steel plant of the Colorado Fuel and Iron Company, Pueblo, Colo., will be enlarged.

James J. Quinlan, of Muncie, Ind., is considering plans for the erection of a boiler factory.

The Los Angeles Can Company, Los Angeles, Cal., is building an addition to its factory.

The shops of the Chicago, Burlington & Quincy Railroad, at Hannibal, Mo., are being rebuilt.

The Atchison, Topeka & Santa Fe Railway will erect new shops and roundhouse at Sweetwater, Tex.

The Advance Thresher Company, Aberdeen, S. D., has let contract for the erection of a large repair shop.

B. G. Holmes, Redlands, Cal., will erect a commercial garage and repair shop. Modern equipment will be installed.

The Butler Manufacturing Company, Kansas City, Mo., has taken out a permit for a one-story factory at Twelfth street and Eastern avenue. The concern makes steel tanks.

The Schubert Aeroplane Manufacturing Company has been formed at San Jose, Cal., with $50,000 capital by Julius Wladowsky, W. R. Lawson, Agyl Campbell and others.

The Wells-Fargo Company, Los Angeles, Cal., contemplate the erection of a large modern garage and stables. Equipment will be required. J. H. Humphries, San Francisco, Cal., is in charge.

The Western Steel and Iron Company, with a capital of $500,000, has been chartered to build a steel plant at Pittsburg, Kan. The incorporators are George H. Holzbog, Jefferson, Ind.; W. A. Cox, Baltimore, Md.; J. N. Haymaker, Wichita, Kan., and Walter Baird and D. A. Snyder, Pittsburg, Kan.

CANADA

Lumby-Stenhouse, Ltd., is building a machine shop and foundry at Fort Williams, Ont.

FOREIGN

Fritz Mettegang's Erben, Witkowitz, in Mahren, Austria, is in the market for saw blades for metal sawing, cold-sawing machines, cylinder saws.

P. A. v. d. Raadt, Eendrachstraat 50, Haarlem, Holland, desire catalogs and quotations on tools for metalworking and woodworking purposes, pumps and fittings, tubular boilers.

General Manufacturing

NEW ENGLAND

R. M. Baker is to erect a new tannery at Portsmouth, N. H.

The Cushnoc Paper Company, Augusta, Me., will erect a new mill.

The town of Fitchburg Mass., is to expend $35,000 for water meters.

The town of Uxbridge, Mass., is to expend $95,000 for a new water system.

The Salem Box Company's plant, Salem, Mass., was badly damaged by fire.

The plant of the Macrodi Fibre Company, Woonsocket, R. I., was badly burned.

The Providence (R. I.) Box and Lumber Company will erect a factory at Arlington, R. I.

The Eastern Oil and Refining Company is to make additions to its plant at Portsmouth, N. H.

The Colonial Paper Company, Portsmouth, N. H., is to make extensive alterations to its plant.

The Crystal Confectionery Company, Burlington, Vt., will move to larger quarters in its new building now being erected.

The Harvard Brewing Company, Lowell, Mass., is making extensive additions, including a condenser and storage building.

The New England Purity Paper Bottle Company, Northampton, Mass., has been incorporated with $50,000 capital. Frank N. Look, of Florence, is president. Headquarters will be in the Kingsbury box factory.

The Springfield (Mass.) Photo-Engraving Company says that the item in a recent issue that its plant was badly damaged, is misleading, as while there was a fire in the lower part of the building business was not greatly interfered with and is running again in full.

MIDDLE STATES

The Aeolian Company, Garwood, N. J., will erect a new power plant.

The Gurley Water Company will erect a pumping plant at Big Run, Penn.

The Water Clarke Lumber Company, of Superior, Wis., will erect an addition.

Portsmouth, Ohio, has voted to issue $100,000 bonds for new waterworks plant.

A new pumping station will be built for the waterworks at West Carrollton, Ohio.

The H. Pervilac & Co., Lyons, France, are negotiating for a silk-mill site at Paterson, N. J.

The Feiber Biscuit Company, Columbus, Ohio, is having plans prepared for a new plant.

The Pittsburg (Penn.) Packing Company is erecting an addition to its refrigerating plant.

The Clayville (N. Y.) Knitting Company is preparing to increase the capacity of its plant.

Plans have been prepared for a power house for Chalfont Brothers, at Forty-fourth and Thompson street, Philadelphia, Penn.

The Mandt Wagon Company, of Stoughton, Wis., will modernize the balance of its plant, and will increase its number of employees to 900.

Murphy & Ronan, carriage manufacturers, 832 Broadway, Albany, N. Y., have secured site for a new plant at Pleasant and North Pearl streets.

Papers were filed with the Secretary of State increasing the capital stock of the Buckeye Pipe Company, of Akron, from $150,000 to $300,000 to provide additional facilities.

Enamel Vitrified Brick Company, Toledo, Ohio, has been formed to manufacture and sell enamel and vitrified bricks, terra cotta and other clay products. Incorporators, J. J. Urschel, George C. Penny, F. M. Dotson, etc. Capital, $100,000.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 20, for 60,400 pounds angle steel, 21,100 pounds medium steel, 4700 medium plate steel, 66,700 pounds black galvanized sheet steel (schedule 3123).

SOUTHERN STATES

Russell, Ky., voted to issue $25,000 bonds for waterworks.

T. W. Jay, Leesburg, Fla., will establish a wagon factory and repair shop.

American Box Company, Lynchburg, Va., contemplates erection of a $50,000 plant.

Berkley Box and Lumber Company, Norfolk, Va., will double its present capacity.

Union Investment Company, Live Oak, Fla., will improve and extend its electric-light system.

City of Doerum, Ga., will vote on $6500 bond issue for waterworks. J. L. Dowling, mayor.

The Crisfield (Md.) Cold Storage Company has awarded contract for the erection of a cold-storage plant.

The Portsmouth (Va.) Cotton Oil Refining Corporation, will build an $80,000 plant to replace the one destroyed by fire.

The River Falls (N. C.) Cotton Mills Company will soon start the erection of a plant. J. W. Menefee, Graham, N. C., is president and general manager.

The city of Chase City, Va., has authorized J. Kent White, Waynesboro, Va., to prepare plans and specifications for waterworks and electric-light plant.

WEST OF THE MISSISSIPPI

City of Fairfax, Okla., voted to construct waterworks.

The Olsen Knitting Works, at Atlantic, Iowa, will be enlarged.

A. Lavergne, San Bernardino, Cal., will erect a modern laundry.

Heating equipment will be required in the city hall at Ocean Park, Cal.

The White Rose Creamery, at Marcus, Iowa, was burned. Loss, $2000.

The People's Ice and Fuel Company, Phœnix, Ariz., will enlarge its plant.

Strong & Dickinson, Coachella, Cal., contemplate the erection of a cotton gin.

The city of Glendale, Cal., will install additional electric equipment at its plant.

Ray M. Hart and associates, Lewiston, Idaho, will erect a gas plant in this city.

The city of Ashland, Ore., has begun the construction on a municipal power plant.

The Miracle Pressed Stone Company will erect a factory at Peru, Neb., next spring.

R. H. Parsons & Co., Cresswell, Ore., are making improvements in their water system.

The Diamond Lumber and Wrecking Company, Los Angeles, Cal., is building a planing mill.

The Globe Grain and Milling Company, Los Angeles, Cal., is building an addition to its plant.

The Pacific Gas and Electric Company, Oakland, Cal., is building an addition to its plant.

The city of Pasadena, Cal., will install additional electrical equipment in its municipal plant.

The St. Paul (Minn.) Tannery is planning to erect a new foundry and erect a power plant.

The Tulsa (Okla.) Corporation contemplates increasing the capacity of its electric-light plant.

The Placentia Packing House Association, Placentia, Cal., will erect a new packing house.

J. C. Kubias, Redlands, Cal., will erect a boiler and engine house addition to his olive factory.

The Syverson Lumber Company's plant, at Montesano, Wash., was damaged by fire. Loss, $25,000.

Forty-thousand-dollar bonds have been voted for the construction of a gas plant at Newton, Iowa.

Equipment will be required in the new hotel to be erected at Santa Monica, Cal., by Mrs. Rosa Borde.

The Glendora Irrigating Company, Glendora, Cal., will make extensive improvements in its irrigating system.

The Sacramento Valley Power Company, Chico, Cal., contemplates enlarging and extending its plant.

The city water commission, at San Bernardino, Cal., will make improvements in the local water system.

T. M. Morton and M. H. Fisher will build a hydro-electric plant in Box Cañon, Alamogordo, New Mexico.

The city of Pasadena, Cal., is in the market for a gasolene engine for a street sweeper, to cost about $400.

J. R. Baird, Perris, Cal., will install a pumping plant with modern equipment on his 160-acre ranch.

The Portland Gas and Coke Company, Portland, Ore., will expend $500,000 in improvements in its system.

The Lewiston-Clarkston Improvement Company, Lewiston, Idaho, will enlarge its steam plant on Snake river.

The San Ysidore Association, San Diego, Cal., will issue bonds for $20,000 for a water and irrigation system.

The city of Hanford, Cal., will install a sewer system to cost $60,000. Bonds for this amount have been voted.

O. M. Enslow, engineer, Berkeley, Cal., contemplates the erection of a power plant at French Creek, Oroville, Cal.

A. G. C. Hahn, Menlo Park, near San Francisco, Cal., will install a pump house and equipment on his property.

The Union Ice Company, Alameda street, Los Angeles, Cal., is making improvements in its plant to cost $100,000.

The Pacific Ammonia and Chemical Company, of Seattle, Wash., has secured a 3-acre site for erection of a plant.

The Redlands & Yucaipa Land Company, Redlands, Cal., is making extensive improvements in its irrigation system.

D. E. Witt, Trout Lake Valley, near Guler, Wash., will install a power plant to generate for light and power on his ranch.

The Midway Pacific Oil Company, Bakersfield, Cal., is installing new equipment in its field and contemplate improvements.

The city of Imperial, Cal., will install a municipal water-pumping plant. T. E. Trask, consulting engineer, Los Angeles, Cal.

The Northern California Power Company has begun the construction of a new power plant at Coleman, on Battle Creek, Cal.

City officials at Worth, Cal. (near Porterville), can furnish information regarding a new packing house to be erected there.

The Vienna Pearl Button Company, Muscatine, Iowa, will erect an addition. An electric power plant will also be erected.

Charles Weise, of Charles City, Iowa, will erect a two-story addition to his creamery. Electric and steam power is to be installed.

Steam-heating and vacuum-cleaning apparatus will be installed in the apartment house to be erected by R. H. Howell, Los Angeles, Cal.

Equipment will be required in the new polytechnic high school to be erected at Santa Monica, Cal. Bonds for $100,000 will be voted.

The Pacific Burial Case Company, Los Angeles, Cal., has taken out a permit to build a factory. Modern equipment will be installed.

The Lewiston-Clarkston Improvement Company, Clarkston, Wash., will expend $100,000 on improvements in its power and electric systems.

The Stockwell-Haley Company, Los Angeles, Cal., will build a warehouse at Alameda and Seaton streets. Modern equipment will be installed.

The board of education, Long Beach, Cal., has voted $3600 for the purchase of automatic heat regulators for the new polytechnic high school.

G. A. Chisholm, Hermiston, Ore., has been granted a franchise by the city council to build an electric plant. Operations will begin at an early date.

The California Moving Picture Company will establish a factory for the manufacture of films at Sixth street and Alamitos avenue, Long Beach, Cal.

The Farley & Loetscher Company, of Dubuque, Iowa, a large sash- and door-manufacturing concern, is planning the erection of a factory in Des Moines.

The Augustias Dolores and Annex Mining Company, operating at Pozos section, Guanajuato, Mexico, are making improvements in their power-plant equipment.

Equipment will be required in the new 10-story office building to be erected at Second street and Broadway, Los Angeles, Cal., by the Broadway Investment Company.

Mechanical equipment and vacuum-cleaning apparatus will be required in the new theater and store building to be erected at San Diego, Cal., by John D. Spreckels, of San Diego.

A gravity system of heating and ventilation will be installed in the new church of St. Bernardine, San Bernardino, Cal. Jeffrey & Van Trees, architects, Los Angeles, Cal.

Heating equipment will be required in the new apartment building to be erected at Clay and Devisadero streets, San Francisco, Cal. O'Brien Brothers, architects, San Francisco, Cal.

Equipment will be required in the new hotel to be erected at Kearny and Sutter streets, San Francisco, Cal., by the Davis estate. L. B. Dutton, San Francisco, architect.

The Mexican National Gas Company, operating at Mexico City and vicinity, contemplates extensive improvements in its plants. E. L. Doheny, Los Angeles, Cal., is head of this company.

Steam-heating equipment, a vacuum-cleaning system and septic tank sewage apparatus will be required in the new hotel to be erected at Woodlake, Cal., by Gilbert F. Stevenson, of Visalia, Cal.

The board of public works, Los Angeles, Cal., will receive bids up to December 23, for furnishing steel and rivets necessary to construct 1409 feet of steel siphon, 9 feet 6 inches in diameter.

The Mexican Asphalt Paving and Construction Company will erect plants at Monterey, Morelia and Durango, Mexico. Edward L. Doheny, Los Angeles, Cal., is at the head of this company.

The Midland Manufacturing Company, of Mason City, Iowa, D. B. Dutro, owner, will erect an addition to its factory. A 60-horsepower electric motor and woodworking machinery will be installed.

Heating and ventilating equipment and vacuum cleaning apparatus will be installed at the new court house at Sacramento, Cal. The Rickon-Erhart Construction Company, San Francisco, has the general contract.

Power-plant equipment will be installed in the new athletic club house of the Los Angeles Athletic Club, Los Angeles, Cal. The building and equipment will cost $650,000. Weymouth Crowell, Los Angeles, Cal., has a general contract for the construction.

CANADA

Red Deer, Alberta, will install a hydro-electric plant.

Toronto, Ont., is in the market for road-making machinery.

E. R. Gabett will locate a large creosote factory at Winnipeg.

The C. Turnbull Company, of Galt, will double its woolen mills.

The town of Gleichen, Alberta, will install a new waterworks system.

W. H. Tapley will locate a large cement plant at Penticton, B. C.

The town of Gretna, Manitoba, will install a new electric-lighting plant.

The St. George Dillon Company will equip a large brewery at Montreal.

The Imperial Oil Company will locate a plant at Melville, Saskatchewan.

The Thomas Shoe Company will equip a large new factory at Lindsay, Ont.

Mortimore Cumming will build a large sash and door factory at Westboro, Ont.

The Elder Carriage Company will build a big addition to its Toronto factory.

The American Pad and Textile Company will build a new factory at Chatham, Ont.

W. C. Franz will locate a large paper-manufacturing plant at Sault Ste. Marie, Ont.

Montreal will spend $2,300,000 for new waterworks equipment, including a filtration plant.

The town of Sault au Recollect, Quebec, will spend $80,000 for new waterworks machinery.

The Rice Malting Company will spend $255,000 on a new plant at St. Boniface, Manitoba.

The Canadian Cotton and Silk Company is equipping a large $150,000 factory at Beauport, Quebec.

The Spanish River Pulp and Paper Company will spend $600,000 on a new plant at Spanish River.

The Sherbrooke Street Railway Company, of Sherbrooke, Quebec, is building a large new power house.

The Alexander Cross Company will build a $40,000 plant at Sydney, Nova Scotia, for treating steel products.

The Red Fir Lumber Company will equip an immense new mill at Vancouver with the latest electrical machinery.

John Turner & Son, 479 Yonge street, Toronto, would like to hear from manufacturers of chilled rolls for flour mills.

The Alberta Electric Railway Company, head offices at Medicine Hat, Alberta, will buy large quantities of equipment.

Western Iron Works, Ltd., Winnipeg, Man., desires to receive quotations on malleable-iron fittings, such as tees, crosses, flanges, etc.

The Lethbridge Brewing and Malting Company, of Lethbridge, Alberta, will spend $150,000 extending its plant and buying new machinery.

The National Securities Company will install an electric-lighting plant at Watrous, Saskatchewan, and will also build a car line and power houses.

MINING

The Empire Mines Company, Nevada City, Nev., will install a modern cyanide plant.

The Lowell mines, near Bisbee, Ariz., are making improvements in their equipment.

The Tarantula mine, in the vicinity of Oroville, Cal., will install a 20-ton stamp mill.

W. E. Pomeroy, operating in matte at Mina, Mexico, is installing a 75-ton smelter at this plant.

The Mason Valley Mines Company, Yerrington, Nev., will build a large smelter to cost $500,000.

The Sharp Fellows Company, operating on Kings River, Cal., is building a large rock-crushing plant.

The San Cayetano properties of Guanajuato, Mexico, will soon be in the market for a milling plant.

The Czar mine, near Bisbee, Ariz., is installing additional hoisting apparatus, electrically operated.

The Mines Exploration Company, at Pachuca, Mexico, is making extensive improvements in its plants.

The Malapi mines (A. S. Hickey, manager), located near Prescott, Ariz., are making improvements in their plant.

The Paradise mine (Manager, H. Galeron), near Barstow, Cal., has completed the erection of a 10-ton stamp mill.

The La Tuia Mining Company, La Luz, Guanajuato, Mexico, is erecting a large stamp mill and making improvements.

The Santa Maria de la Paz Mining Company, of Guanajuato, Mexico, is making extensive improvements in its plant.

The Gold Bug Mining Company, operating near Kingman, Ariz., contemplates the installation of a large milling plant.

The Calumet & Arizona Mining Company, operating near Bisbee, Ariz., contemplates enlargements and extensive improvements.

Cleveland & Weatherhead, operating the Deadwood mines, near Silver City, New Mexico, are making improvements in their plant.

The Golden State Company, operating in the Whipple Wash country, near Parker, Ariz., will be in the market for a concentrating mill.

The La Dura Mining Company, operating near Douglas, Ariz., will make extensive improvements in its plant, installing labor-saving devices.

The Ruth Mining Company, operating in the San Francisco district, near Kingman, Ariz., will install a milling plant of 50 tons daily capacity.

The Natividad and Annex Company, operating at Sierra Juarez, Oaxaca, Mexico, will soon be in the market for equipment for a 500-horsepower electric plant.

The Compania Beneficiadora de Metales de Atotonilco, operating at El Chico, Pachuca district, Mexico, will install a mill and cyanide plant of 100 tons daily capacity.

The Giroux Consolidated Mining Company, operating near Ely, Nevada, will make extensive improvements and will be in the market for concentrator and smelting machinery.

Collin Timmons, principal owner of the Guerrero Mining and Milling Company, operating the Las Varones Antigua mine, Guerrero, Mexico, will make extensive improvements in his plant.

The Santa Virginia Mine and Milling Company, operating the Santa Virginia, Plomosa and Mariposa mines in Tepic, Mexico, will make extensive improvements in its plant, installing a concentration-cyanide reduction plant.

The Copper Queen Mining Company, near Douglas, Ariz., will make extensive improvements in its plant. Reverberatory furnaces, roasters, etc., will be installed. A new building and stack will be erected. Turbines will be installed.

BUSINESS ITEMS

The Foote-Burt Company, Cleveland, Ohio, has opened an office at 827 Ford building. H. C. Rose, manager.

The Norton Company has appointed Chas. Churchill & Co., Ltd., sole agents for Great Britain for Norton grinding wheels.

David Landau and F. D. Howe have succeeded to the engineering business of Landau & Golden, 1779 Broadway, New York City.

TRADE CATALOGS

The J. E. Poorman Company, Inc., 1825 Bristol street, Philadelphia, Penn. Circular. High-speed tap wrench. Illustrated.

Bay State Grinder Company, Worcester, Mass. Circulars. Piston-ring grinders, cam and valve-face grinder. Illustrated.

The Beaman & Smith Company, Providence, R. I. Special Pamphlet No. 22. No. 10 boring and milling machine. Illustrated, 4 pages.

F. E. Wells & Son Company, Greenfield, Mass. Catalog No. 8. Manual training machinery. Illustrated, 20 pages, 6x9 inches, paper.

Joseph Dixon Crucible Company, Jersey City, N. J. Pamphlet. Graphite products for the railroad. Illustrated, 38 pages, 5½x8½ inches.

Becker Milling Machine Company, Hyde Park, Mass. Pamphlet No. 56. New model belted vertical spindle milling machines. Illustrated, 24 pages, 6x9 inches.

FORTHCOMING MEETINGS

The next meeting of the executive committee of the National Metal Trades Association will be held at Hotel Astor on December 6. The annual meeting on April 14, 1911, at the same place. The quarterly meeting of the Cincinnati, Ohio, branch will take place at the Business Men's Club, on the evening of December 8.

American Society of Mechanical Engineers, annual meeting, December 6-9, New York. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Society of Automobile Engineers, annual meeting, January 11 and 12, New York City; C. F. Clarkson, secretary, 1451 Broadway, New York City.

The National Civic Federation, eleventh annual meeting, January 12-14, New York City; D. L. Cease, secretary, 1 Madison avenue, New York City.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Wanted—Work for turret lathes and gear cutter. Box 222, AMERICAN MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

The "Gas Saver" brazing forge; circular. J. L. Lucas & Son, 2 Fox St., Bridgeport, Ct.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery designed; drafting, tests, reports. Reliance Eng. Co., 113 Beekman street, New York City.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Spur gear cutter to take 8-foot gears; state condition fully and where can be seen. Dillon-Box Iron Works Co., Denver, Colo.

Wanted—Well equipped machine shop wants specialty or article of general manufacture to make and sell under royalty arrangement, or will buy outright. Box 219, AMER. MACH.

Wanted—Estimates, to furnish on contract printing machines weighing 4000 pounds each, to be built in lots of 100; specifications furnished only to competent and reliable parties. "A. B. C.," AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Nutter & Barnes Company, Boston, Mass., have one of the best equipped machine shops and solicit lathe, planer, milling machine, turret lathe, drill, gas engine or automobile machine parts work, by day or contract.

Those breaks on power plant or machinery! Are you going to lose time awaiting new parts from makers, or will you let us weld them at one-fourth to three-eighths cost of replacements? Reshipment within 24 hours. Oxyacetylene process, producing homogeneous weld of cast iron. No charge unless successful. Waterbury Welding Works, Waterbury, Conn.

Punches and dies designed, drawn up in detail and covered by specifications, for all kinds of blanking, forming, twisting and drawing dies; why have a shop full of high priced men, when you can have your dies go into the factory drawn up so any machinist can go to work and build your tools without spending hours scheming how he is going to do the job. Send us a sketch, blueprint, or a sample, and we will do the rest. For further particulars, write to Box 223, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—A first class machinist to start foundry and machine shop with a molder in a town in California, 150 miles northeast of San Francisco. Inquire of Ed. Baerlocher, Grants Pass, Ore.

CANADA

Diemakers Wanted—Two or three experienced diemakers; those accustomed to work on trunk hardware preferred. Box 206, AM. M.

CONNECTICUT

Wanted—By a concern building high grade automatic machinery, a working foreman over four large planers, seven horizontal boring mills and one 60-inch Bullard vertical mill; good opportunity for an energetic young man who wishes to locate with a reliable concern; nationality no objection; when answering, state full particulars. Box 213, AMER. MACH.

DISTRICT OF COLUMBIA

United States Navy wants machinists; pay $44 to $77 per month, clear of living expenses, with splendid chance for promotion to warrant machinist at $1200 to $2100 per year; the life is healthy and different forms of athletics are encouraged; the food is wholesome and plentiful, and the opportunity to save money and see some of the United States and foreign countries is excellent. Send for free illustrated booklet which tells all about navy pay, play, promotion, etc. Address Bureau of Navigation, Navy Department, Washington, D. C.

ILLINOIS

Wanted—Experienced machinist capable doing pattern work; also assistant. Fetzer & Co., Springfield, Ill.

MASSACHUSETTS

Head draftsman and designer, experienced on rotary printing presses and folders. Box 132, AMERICAN MACHINIST.

A company, building high grade machine tools which they sell direct, require men who have the ability to make first class demonstrators; they must have mechanical ability, be diplomatic and persistent; the right men will be given a course of instruction in the shop, and a good position; unmarried men preferred; give full information as to experience, age, etc. Box 233, AMER. MACHINIST.

MICHIGAN

Draftsman to lay out and detail heavy machinery; state qualifications; experienced man required. Box 224, AMERICAN MACHINIST.

Wanted—Experienced assemblers and mounters for machine tool work; steady work and good wages to the right man; ideal shop conditions. Grant & Wood Mfg. Co., Chelsea, Mich.

Wanted—Foreman in factory making woodworking machinery; see advertisement in *Wood Craft and Wood Worker;* state experience and salary wanted; also references. Valley City Machine Works, Grand Rapids, Mich.

Wanted—Superintendent for drop forge department, employing fifty to sixty men; steam and board hammers and unsetters; manufacture axles, crank shafts and general forgings; want a hustler who can get out production and handle men; factory located in lower Michigan; state age, experience, references, salary desired and where employed; correspondence confidential. "Drop Forge," AM. M.

NEW JERSEY

Wanted—First class gas engine man; one capable of repairing and keeping in first class condition, twenty White & Middleton gas engines, located in different parts of the State of New Jersey; state age, experience and salary expected. Wm. Simonds, 604 Stuyvesant Ave., Irvington, N. J.

NEW YORK

Wanted—Northern New York, competent, detail, gas engine draftsmen; $15 per week; state age, training, full details, last five years work with salaries received. Box 221, AM. M.

Boiler fuel economy; agent required in the United States for the sale of scientific instrument selling freely and in successful operation in Europe and British Colonies; price each, about $200. Box 175, AMER. MACH.

General superintendent wanted by engineering foundry and machine company, long established with annual business about $1,000,000; short distance from New York City; 500 men; salary no limit to proper person. "G. S.," Care AMERICAN MACHINIST.

German mechanical engineer wanted; to introduce American hydraulic apparatus in Germany; must possess technical education, some American experience and suitable references. Address by letter only, stating salary desired. T. L. Van Norden, 90 West St., New York City.

Draftsman (mechanical) wanted in drafting department of publishing house (New York City) to make technical illustrations; essential to know how to read blueprints; must be neat, rapid tracer and possess skill in free hand lettering; state age, qualifications and terms. Box 218, AMERICAN MACHINIST.

OHIO

One machine shop foreman, thoroughly acquainted with piece work. Box 225, AM. MA.

Wanted—A first class machine tool salesman to travel in the Middle West. Box 212, AMERICAN MACHINIST.

Wanted—Boring bar and boring mill men at once; night shift; state age and experience. The Heisler Company, St. Marys, Ohio.

Foreman wanted on erecting floor in locomotive works; state age, experience and address. Box 208, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Experienced man to take charge of automatic screw machine department; must be familiar with Cleveland and other makes. Box 196, AMERICAN MACHINIST.

WISCONSIN

Expert tool designer, having shop experience as well as technical training in pressed steel work to take charge of tool drafting room for large stamping plant in Milwaukee; unusual opportunity for an ambitious and capable man; state salary and past experience. Box 166, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Mechanical engineer, ability as designer and cost reducer, desires responsible position. Box 217, AMERICAN MACHINIST.

ILLINOIS

General foreman, thoroughly familiar with interchangeable manufacture, would consider a better position; age 32; technical education. Box 230, AMERICAN MACHINIST.

Toolmaker, A-1 practical, can design and build uptodate jigs, punches, dies, tools for general manufacturing, wishes position as foreman; 13 years' practical experience; 4½ years foreman, will go anywhere. Box 214, AMERICAN MACHINIST.

MASSACHUSETTS

Assistant superintendent or general foreman; A-1 tool and machine designer; can get maximum output from equipment; age 34. Box 174, AMERICAN MACHINIST.

NEW YORK

An A-1 designer of gas and automobile engines seeks position; A-1 references. Box 227, AMERICAN MACHINIST.

Mechanical draftsman, seventeen years' experience, three years shop; college graduate; thirty-six years old. Box 216, AM. MACH.

Mechanical draftsman with office and shop experience on automobile and general machinery, wants position at once. "E. M.," AM. M.

Draftsman, special machine and tool designer, interchangeable parts; 10 years' experience; location immaterial. Box 207, AMERICAN MACHINIST.

Who needs the services of a first class tool room or machine shop foreman, with 25 years' of successful experience as A-1 mechanic. Box 220, AMERICAN MACHINIST.

Graduate mechanical engineer, experienced designer and chief draftsman, 28, now employed, desires position offering a future. Box 200, AMERICAN MACHINIST.

Factory cost clerk and accountant wishes to change position; machine shop and factory experience; age 25; first class references. Box 232, AMERICAN MACHINIST.

Graduate mechanical engineer, two years' machine shop, four years' drafting experience, best reference, desires position. "B," 202 East Sixty-ninth street, New York City.

Mechanical superintendent, general foreman, experienced on automatic machine design, sheet metal drawing, screw machines, eyelet machines, turret lathe, general machine work. Box 231, AMERICAN MACHINIST.

In West, Middle or Southwest, position requiring a high grade man with brains, initiative, ability and experience; salary secondary consideration; engineering, mining or manufacturing. Box 226, AMERICAN MACHINIST.

Foreman, 34, now engaged; medium or heavy work; thoroughly conversant with piece work and uptodate methods; electrical or general machinery; references from present employer. Box 203, AMER. MACHINIST.

Successful manager, five years present company, experienced in buying, designing, production and business management, seeks change for best of reasons; American; forty; energetic, conscientious, high grade. Box 229, AMERICAN MACHINIST.

Superintendent by experienced factory manager; energetic and economical; proficient at speeding help, organizing facilities, producing highest grade of work at lowest cost, and hustle out work; expert at tools, dies, fixtures and machinery; can produce results at once; highest reference. Address "Mechanical Engineer," 91 Sixth avenue, Brooklyn, N. Y.

Situation Wanted — Mechanical engineer, with executive ability and practical experience that will meet the most exacting requirements in uptodate designing and manufacturing of tools and machinery to increase production. Box 201, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—By expert tool and machinery designer, position as tool room foreman, general foreman, screw machine foreman, or factory manager; 10 years' experience in manufacture of fine interchangeable parts; also design and construction of all automatic machinery, including tools, dies and fixtures for the above; executive ability and technical training; married; age 30; references. Box 228, AMERICAN MACHINIST.

TENNESSEE

Graduate mechanical engineer; knowledge of electricity; good salesman; special machine and tool designer, interchangeable parts; seven years' experience in three different countries; speaks four languages; location immaterial. Box 215, AMER. MACH.

FOR SALE

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Talks With Our Readers

By the Sales Manager

The knowledge that you can have faith in a man is certainly worth a good deal.

To know that such and such a man will answer to the call for help, whenever help is needed, unfailingly, gladly and with ability to supply just the help needed—

Is as good and better than a good-sized balance at the bank.

Yet how much faith do you think you'd have in a man who tried to fool you—in a salesman, say, who tried to sell you something that was practically worthless.

How many repeat orders would he get from you?

How long would he be apt to stay in business if he depended upon orders from you or your friends?

A mighty short time, we venture to predict. Faith gone—confidence gone—all chance of doing business is gone.

And, true as this is where personal salesmanship is concerned, just so true is it where salesmanship through the printed pages of your paper is concerned.

A concern with an article that did not do exactly what was claimed for it could no more succeed in selling it repeatedly through advertising than could the flesh and blood salesman.

And its advertising would not appear in your paper very long.

Not only because we would not print it knowing that the goods were not right in every particular—

But also because you wouldn't think for a minute of doing business with a concern in which you couldn't have perfect faith.

Yet, when a man advertises a tool and after trying it you find it is as helpful a device as it has been advertised to be—

When it gives you better service than you expected—

You have no hesitation in doing further business with the house you bought it from.

You have faith in its claims, in its statements about any goods they offer for your consideration.

And that's where the great value of the advertising pages of your paper comes in.

Start from the back or start from the front, read the small advertisements or read the large ones—

The big thing which impresses you is the fact that they all seem announcements from friends—

The names are familiar—you have seen them week after week—some for as many as thirty and more years.

And the reason they are familiar to you—the reason they look like friends somehow or other—is just because they make tools that you can have faith in, products which come up to the mark.

The selling section is indeed a "friend in need," it will answer your call for assistance every time you appeal to it.

Because the concerns who advertise year after year in your paper have proven time and again, to the satisfaction of the skeptical and the non-skeptical, that faith in them is not misplaced.

A careful reading of the selling section in this issue will "show you."

* * *

Only reliable goods can be continuously advertised.